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VETERINARY MEDICINE

April, 1930

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Contents

Johne's Disease 136
Notes on Feeding Baby Beef 136
Notes on Feeding Swine 136
Dairymen Favor Abortion Test 137
Tularemia in Sheep 138
Infectious Ano-Vulvitis of Cattle 139
Infectious Abortion in Michigan 140
Botulism in Horses 141
Fined for Obstructing Cattle Test 142
Prospects in Tuberculosis Eradication 143
Thereapeutic Indications for Potassium Iodid 144
Furunculosis in a Dog 152
Chloral Narcosis in the Dog 152
Destroying Animals Painlessly 153
Vaccination and Agalactia 153
Control of Pullorum Disease 154
Cowherb Injurious to Chickens 159
Poison Fungi on Barley 159
Vaccination for Prevention of Fowl Pox 160
Agglutination Reactions for Pullorum Disease 160
Iodin Tolerance of Farm Animals 162
Rickettsia Ruminantium 162
Contagious Pleuo-Pneumonia 163
Contagious Abortion in Africa 163
Hemorrhagic Septicemia 164
Avoiding Livestock Losses in Shipping 165
Vaccination Against Tuberculosis 165
Topography of the Abdominal Organs 166
Skin Lesions of Tuberculosis 166
Control of Breeding Diseases 167
Duration of Pregancy an Index of Health 172

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D. M. Campbell, Editor A. T. Kinsley, Associate Editor

It has been estimated that 15 trillion typhoid bacilli weigh one ounce.

It has been estimated that about one-tenth of the graduate veterinarians in the United States are engaged in tuberculosis eradication work.

The presence of hydrochloric acid in human gastric juice was demonstrated to the Royal Society in London by Tom Prouts in 1823.

It has been estimated that live stock have consumed approximately 200,000,000 board feet of potential timber in the past twenty years in the Coconino and Tusayan National Forests in Arizona.—*Science.*

A high moisture content characterizes the flesh of emaciated cattle. The moisture content of the flesh of normal cattle is from 18% to 25%, whereas the moisture content of the flesh of emaciated cattle is in excess of 25%.

The surplus butter in storage that caused the tremendous drop in the price of butter fat in the early winter was only 41,000,000 pounds. The oleomargarine consumed by farm families during 1929 totaled 60,000,000 pounds. A farm family of moderate size can save $40 a year by substituting oleomargarine for butter. A ten-cow farmer can lose this amount per month by the drop in the price of butter fat.

Soybean hay or straw is highly recommended as roughage for horses and mules.

Some practitioners are enlarging their scope of usefulness and increasing their income by testing chickens for pullorum infection.

All classes of swine should receive mineral supplements unless they are fed a ration of dairy by-products, tankage or are running on green pasture.

Avian tuberculosis has been found quite widespread in Kansas. Infected flocks have been found from the eastern border to the extreme western part of the state.

The successful elimination of internal parasites gives temporary relief to the infested animal, but is of little value in controlling the condition unless reinfestation is prevented by destroying the expelled parasites and placing the treated animals on soil that is not infested.

Anthrax spores may remain viable and virulent in polluted water for 18½ years, according to Hastings. Tests were made on samples of water that had been polluted from a tannery. The samples of water were kept in glass stoppered bottles and subjected to the varying temperatures of the laboratory for 18½ years. If anthrax spores will remain virulent for 18½ years in water, how long may they survive in soil?

Cleansing by hot water and soap is of value not only in actually washing away infection but also actually destroying some pathogenic bacteria.

Tuberculosis is considered to be the gravest of the three great problems of cattle breeding in Germany. The other two are mastitis and contagious abortion.

The short time as well as the long time program for the dairy farmer is to sell to the butcher his poorer producers. It is sound business at any time and particularly at this time when dairy prices are relatively low and beef prices relatively high. This is the time to reduce the herd. Sell from the bottom, not from the top. One-third of all our cows do not even pay for the feed they consume.—*Hoards Dairyman.*

In Germany there are nearly 10 million cows which produce yearly approximately 5,000 million gallons of milk of value about 1,500 million dollars. About 60% is used for the manufacture of butter, cheese and other milk products or for animal feeding, whilst the remainder, about 2,000 million gallons, is sold for direct consumption. This equals about two-thirds of a pint per head of the population and is greater than that of England, though distinctly below that of the U. S. A.—*The Veterinary Record.*

German writers have estimated that their annual loss from mastitis approaches the sum of 200 million marks ($50,000,000).

In Germany, as elsewhere, streptococci are by far the most common cause of mastitis and probably account for not less than 85% of cases. It is estimated that between 10 and 20% of all cows are affected, the percentage being lower, 1 to 5%, in the smaller self-contained herds, than in the large *"Abmelkschafte,"* establishments where cows are constantly bought and milked through the current lactation period only. In such establishments mastitis ranges up to 50%.—*The Veterinary Record.*

A ton draft gelding was recently sold by an Iowa farmer for $415.00.

Cod liver oil facilitates the assimilation of calcium. It has recently been demonstrated that it is not necessary to ingest the cod liver oil as sufficient is absorbed when it is applied to the skin of chickens to increase the calcium content of the blood.—*Science.*

Cat fright evidenced by accelerated heart action, hair raising, ear lowering, hissing and snarling are manifestations induced by an increase of adrenin in the blood. In other words, fright in cats is due to chemical change in the blood due to the liberation of adrenin from the adrenal glands.—*Science.*

The specific function of eosinophyllic leucocytes is not known but from analysis of blood, it is apparent that they have some relation to parasitism, certain malignant tumors and perhaps other pathologic and physiologic processes. Recently it has been shown that the eosinophillic leucocyte has some relation to mastoid infection.—*Science.*

Deficiency of vitamin A in feed is evidenced by failure to grow, xerophthalmia, respiratory and digestive disorders. White corn, dried beet pulp and powdered skim milk that is oxidized by exposure to light and air are practically free from vitamin A. Cod liver oil should be provided for animals fed a ration deficient in vitamin A.—*Dairy Science,* Vol 9, No. 2.

The high producing western cows keep in better flesh and condition on liberal rations of alfalfa with little if any grain than most of the eastern and midwestern cows fed liberal rations of grain with little if any alfalfa.

It is an astounding fact that in the eastern half of the United States one may find a thousand or two thousand thin cows in one community, and as many as twenty thousand in some dairy counties that are too thin to do their best work. W. G. Fraser in *Hoard's Dairyman.*

MISSOURI VETERINARIANS

List of Veterinarians Whose Pictures Were Taken Jan. 23rd, 1930, at Special Course for Graduate Veterinarians

1.—H. J. Hearrington, Lexington, Mo.; 2.—F. N. Kirsch, Carrollton, Mo.; 3.—Ray Kelly, Bunceton, Mo.; 4.—J. B. Rand, Bunceton, Mo.; 5.—C. D. Wallace, Buckner, Mo.; 6.—N. S. Campbell, Brookfield, Mo.; 7.—G. L. Reece, Savannah, Mo.; 8.—C. W. Reed, Kansas City, Mo.; 9.—A. W. Uren, Columbia, Mo.; 10.—A. Goodlive, Marshall, Mo.; 11.—J. L. Wright, Salisbury, Mo.; 12.—W. T. Robertson, Hale, Mo.; 13.—S. G. Dreppard, West Plains, Mo.; 14.—A. J. Crumbaugh, Neosho, Mo.; 15.—F. H. Suits, Odessa, Mo.; 16.—F. L. Severs, Pleasant Hill, Mo.; 17.—D. B. Morgan, Neosho, Mo.; 18.—G. W. McIntyre, Mexico, Mo.; 19.—Homer A. Wilson, Jefferson City, Mo.; 20.—W. S. O'Neal, St. Charles, Mo.; 21.—C. R. Kinnison, Chillicothe, Mo.; 22.—E. F. Sanders, Columbia, Mo.; 23.—J. D. Ray, New Center Bldg., Kansas City, Mo.; 24.—A. J. Durant, Columbia, Mo.; 25.—H. E. Biester, Ames, Iowa; 26.—C. E. Salsbery, Kansas City, Mo.; 27.—C. D. Luekert, Blackwater, Mo.; 28.—J. W. Connaway, Columbia, Mo.; 29.—H. C. Carver, Higginsville, Mo.; 30.—O. T. Murphy, Kahoka, Mo.; 31.—E. O. Lucking, DeSoto, Mo.; 33.—J. L. Jones, Blackburn, Mo.; 34.—S. M. Miller, California, Mo.; 35.—E. Gregory, Jefferson City, Mo.; 36.—P. S. Grigsby, Louisiana, Mo.; 37.—Geo. S. Beck, Schell City, Mo.; 38.—E. K. Glover, Kansas City, Mo.; 39.—W. E. Weike, West Plains, Mo.; 40.—J. M. Burns, Nevada, Mo.; 41.—J. F. McGhee, Drexel, Mo.; 42.—H. C. Ward, Fulton, Mo.; 43.—J. C. Booker, Cuba, Mo.; 44.—Carl E. Murphy, Jacksonville, Mo.; 45.—C. N. Hook, Braymer, Mo.; 46.—J. W. Chenoweth, Albany, Mo.; 47.—John L. Wells, Blue Springs, Mo.; 48.—H. P. Hoskins, Detroit, Mich.; 49.—W. F. Guard, Columbus, Ohio; 50.—G. W. Stiles, Denver, Colo.; 51.—O. S. Grisler, Columbia, Mo.; 52.—E. A. Shikles, Dearborn, Mo.; 53.—H. B. Hickman, Malta Bend, Mo.; 54.—N. D. Bernhardt, Enderlin, North Dakota; 55.—E. B. Ward, Jefferson City, Mo.; 56.—G. R. Elliott, Palmyra, Mo.; 57.—Jos. Emonts, St. Charles, Mo.; 58.—J. Harvey, Slater, Carrollton, Mo.

JOHNE'S DISEASE

In 1895 Johne discovered an acid fast bacteria that caused diarrhea in cattle. For many years, it was thought to be the same as the avian tuberculosis bacillus. In 1906 Bang established the fact that the disease it produced is distinct from chronic tuberculosis.

Johne's bacillus was first cultivated by Twort in 1911. Johne's disease was first recognized in the United States by Pierson. It has been recognized in 36 states and probably exists in all.

NOTES ON FEEDING BABY BEEF

A balanced ration is far more important in feeding calves than it is with older cattle.

Two lots of calves were fed, one corn and oat straw, the other corn, cotton seed meal and alfalfa hay. The second lot gained more than one pound a day more than the first lot during a feeding period of 214 days.

Calves on full feed should receive 1½ pounds daily of protein concentrates, or 1 pound per day if clover or alfalfa is fed. A mixed protein concentrate—linseed meal, cotton seed meal and soybean meal is not superior to linseed meal as a feed for calves, but is cheaper.

Molasses and black strap is held in high esteem as a feed by many cattle men, but this opinion is not substantiated by feeding tests. Mixed molasses feeds like molasses and black strap are not satisfactory feeds for calves. Except for ear corn, it is not worth while to grind feed for calves.

Enzymitic compounds as a feed for calves are a delusion.

Green corn is more valuable as a feed for calves than hard corn. Ear corn silage is a good fattener.

If calves are fed corn during the winter they will lose weight when first turned on grass. If fed silage during the winter, they will gain 2½ to 3 pounds daily during the first two months on grass.

NOTES ON SWINE FEEDING

Eighty-five per cent of the total cost of producing hogs is the food cost.

Incorporating a protein supplement in swine feed saves $2.50 on the cost of producing a 225-pound hog. 100 pounds of tankage will save 10 bushels of corn, in feeding hogs. $4.00 worth of tankage saves $7.50 to $9.00 worth of corn.

Linseed meal alone is not a very satisfactory protein supplement for pigs in dry lot feeding. The same is true of cotton seed meal. Soybeans are unsatisfactory as a protein supplement in swine feeding, since 20% of the feed would need to be of soybeans and this produces soft pork. Soybeans, however, are a good protein supplement for brood sows.

The best protein supplement for swine feeding consists of tankage 2 parts, linseed meal 1 part, and alfalfa meal 1 part. This is better than skim milk and cheaper than tankage. It has a protein content of 45% and with corn, constitutes an ideal feed for swine.

The carcass of a 200 pound hog contains 8 pounds of mineral. On good feed, he will have consumed 20 pounds of mineral by the time he reaches that weight.

Less than 20% of the land area of the United States is in harvested crops. By far the larger part of land put to agricultural uses is pasture. 24% of the improved land in Illinois farms is in pasture. 70% of the land producing harvested crops is devoted to the production of feed for live stock. 24% of the wheat produced in the United States is fed to live stock. Ninety per cent of Mr. Legge's problem is live stock marketing which of course includes finding a market for food products of animal origin—i. e., increasing consumption of milk, meat, butter, cheese, etc. If domestic consumption of these problems can be increased only 2% the agricultural surplus will disappear and prosperity will be established on American farms.

OUR DEBT TO OUR COMPETITORS

What do we owe our competitors? Or do we, in fact, owe them anything at all?

Rather jolting questions these, especially when most of us feel that but for our many competitors we might be getting along famously. Many of us think that it is this competition thing that heaps worries upon us and causes us to stagger under the load. Whereas it is competition that keeps us "on our toes." It forces a man to be ever alert in formulating new plans; keeping abreast with the times; continually improving and perfecting his knowledge, methods, and technic.

And it is just this perpetual struggle for more effective ways and means of serving the world with our knowledge and skill that is in itself the compensation of competition. There is in us that human element which wants to slump, to "lie down and rest a while,"—call it apathy, inertia, languor, procrastination, or what you will. Unless some outside stimulus is brought to bear, this lethargic condition will expand and stretch a few "resting moments" into days, weeks, months, and yes even into years.

Thus we see that competition becomes the stimulus that arouses a man to ever renewing activity to put forth greater effort towards the achievement of success. Without this incentive there would be little urge to improve, to excel.

It is not difficult to see that in the science of veterinary medicine a great advance has been made, brought about, no doubt in a large measure, by competition and its constant demand for a higher degree of efficiency, greater operative skill, and more intelligent judgment in matters of diagnosis and treatment. The veterinarian of today feels the need of constant study to familiarize himself with the newer developments in his chosen field and to perfect his operative skill.

That profession or business which is not spurred on by wholesome competition is in danger of degenerating into a decrepid and ineffectual occupation.

The competitive struggle many times brings one to the very crossroads of one's career,—whether it is better to fight one's competitors with weapons such as they may use,—price cuts, white vests, frock coats, "plug" hats, or possibly a more costly automobile; or offer something that the competitor may not have to offer, —a more kindly feeling and consideration for the poor suffering dumb patients in need of treatment, unselfed service, superior operative skill, and surgical judgment. It goes without saying that the latter course offers the more lasting material with which to build enduring success.

Indeed, fair competition should be welcomed. It exists because it stirs us to greater efforts, and it should be looked upon as an impetus to quicken us to an increased endeavor to improve ourselves and our work,—a call to rise higher in professional achievements, to become better diagnosticians, better operators, better veterinarians.

Carleton Cleveland.

Highland Park, Ill.

SEVENTY-FIVE PER CENT OF DAIRY EXHIBITORS BELIEVE IN THE SERUM TEST FOR CONTAGIOUS ABORTION

Questionaires sent to 100 exhibitors at the National Dairy Show, revealed the following:

47% have had their entire herds tested for contagious abortion.

43% have not had their herds tested.

25% of the herds are entirely free from abortion.

40% of the exhibitors contemplate having their herds tested in the immediate future.

60% expressed confidence in the test.

75% would not buy any but negative reacting cows.

98% would like a herd free from aborters.

1% was indifferent to the test.

1% believed it a fraud.

Of ten livestock maladies of major importance widely prevalent in the world, the United States is entirely free from five; it is rapidly eradicating two others, has two more under effective control, and has the tenth under partial control.—J. R. Mohler.

Five important infectious animal diseases from which the United States is entirely free are foot-and-mouth disease, rinderpest, surra, contagious pleuropneumonia, and epizootic lymphangitis. To this group of fearsome livestock enemies may be added others of almost equal importance, including African horse sickness, mal de caderas, nagana, ulcerative lymphangitis, cattle farcy, and European fowl pest. These livestock scourges cause heavy losses in various parts of the world, but are being kept out of the United States by regulation of imports, by quarantine methods, and by veterinary inspection.—J. R. Mohler.

Tick fever of cattle has been eradicated from ten States in the last two decades and now occurs in only five—Arkansas, Florida, Louisiana, Mississippi and Texas. On a square-mile basis tick eradication is about four-fifths completed, and the area still occupied by ticks is being steadily reduced. In addition the spread of ticks to free areas is being successfully controlled by quarantine measures.—J. R. Mohler.

Infectious abortion is now the most serious single livestock malady in the United States. It is serious because of financial losses and because of the discouragement of livestock owners whose efforts toward control have been unsuccessful. Though not so fully understood as some other maladies infectious abortion can be suppressed to a large degree by sanitary measures when these are combined with proper herd management and with the detection of infected animals by veterinary tests. Seven States are cooperating actively with the Bureau of Animal Industry in research which seeks to develop improved methods of controlling and eradicating this disease.—J. R. Mohler.

A survey of the animal-disease situation in the United States just completed by the Bureau of Animal Industry, U. S. Department of Agriculture, reveals the far-reaching effect of veterinary medicine in safeguarding the livestock industry. Of the 35 important diseases that are known to afflict livestock somewhere in the world, only 24 of them are known to be present in the United States, and 17 of these are being effectively controlled or are approaching what is hoped may be complete eradication, the rest of the 24 being under partial control or are objects of study.—J. R. Mohler.

FEED THE AGRICULTURAL SURPLUS TO LIVE STOCK

The biggest factor in marketing farm products is live stock. The advantages of marketing farm products through live stock, are:

1. Larger return for the farm crop.
2. Maintenance of the fertility of the land.
3. Profitable utilization of labor in winter.
4. Avoids the necessity for a large amount of labor for short periods, that is flattens the labor peak.
5. Makes a profitable market for low grade feed.
6. Reduces the farm overhead.

TULAREMIA IN SHEEP

For several years a sheep disease has existed in southern Idaho causing considerable losses among lambs. The disease has been diagnosed as tularemia and is caused by the same organism that affects rabbits and, in some cases, man. The common symptoms in sheep are lagging behind the flock, lying down much of the time, lameness in one or both forelegs, fever, and rapid loss in weight. The disease was found to be associated with infestation of the sheep by ticks, and recovery is rapid as a rule if the ticks are killed or removed before the disease becomes advanced.—J. R. Mohler.

Infectious Ano-Vulvitis of Cattle

By W. B. CHAPMAN, Powersville, Missouri

AS REPORTS of this particular malady have been few and as the severity of the affection in some cases is of considerable economic importance, the writer feels that a discussion of the disorder is appropriate at this time. The fact that the disease is extremely rare in some localities causes the practitioner to pass the subject with little thought or consideration. However, once he meets up with the condition, all available sources of information are diligently searched for more enlightenment concerning the nature of the disease in order that he may cope with the situation confronting him.

Ano-vulvitis has been described by some as a comparatively mild disorder and the treatment as a simple and effective procedure. However, it has been the writer's experience that the infection may reach grave proportions and that effective treatment is sometimes tedious and difficult. In severe outbreaks therapeutic measures must be carried out over a period of time and persistently indulged in to obtain the desired results.

An outbreak of ano-vulvitis occurred in two separate herds in this locality during last January. The herds were three miles distant from each other and despite the fact that the infection occurred in one herd ten days previous to the time from which the other herd was found to be infected, nothing could be traced that would indicate that the two had the same source of infection.

The first outbreak occurred in a herd of one hundred head of coming yearlings. Sixty head of these were heifers and the remainder were steers. Hogs were following these calves and the owner supposed that the hogs had injured the animals. Laboring under this supposition no advice was sought for about four days. The day assistance was called about ten head of the heifers were noticed to be affected. They were put up in a lot and a diagnosis of ano-vulvitis was made. The next day the entire herd was run through a chute and about forty head of heifers were found in various stages of the ailment.

The symptoms were as follows: Temperature, appetite and general appearance normal. Later on as the disease progressed two of the animals in which an enormous amount of sloughing occurred, ran a temperature of 102° F. They were sore and stiff, appetite somewhat impaired and they showed considerable shrinkage. Under treatment this condition gradually improved, and while the general appearance was practically normal in three weeks, the vulva had sloughed entirely away on these two heifers and the area had closed in with scar tissue until a lead pencil could not be inserted into the vagina. This is one of the serious consequences of the affection. In a serious outbreak of the trouble if prompt remedial aid is not given the vagina may close entirely or to such an extent as to interfere with urination.

At the beginning of the trouble the lower commissure of the vulva will be noticed swollen and red. In a day or so a small scab appears, usually on the lowest part of this organ. When this scab is removed there is presented a foul smelling ulcer, covered with a tenacious, yellowish exudate. The surrounding tissues are hyperemic and as the disease progresses the entire vulva and part of the anus may become involved, accompanied by sloughing of these organs and if remedial agents are not effective the entire vulva may rot away.

The following treatment was administered to these heifers: The scabs were removed and the denuded surface thoroughly washed with a 5% solution of Liquor Cresolis Compound. This treatment was continued every other day for three treatments and as the progress of the disease did not seem to be checked any, the wounds were touched up each time, after washing with the liquor cresolis solution, with a 20% solution of

chromic acid. This latter method seemed to give better results than the liquor cresolis solution alone. In fact three treatments with the chromic acid solution showed that the infection was checked. However, there were a few of the animals that needed attention for some time, especially those in which extensive sloughing occurred.

The second outbreak was discovered before it had gained such a foothold as the first and the liquor cresolis and chromic acid solutions were used from the start. Three treatments were all that was necessary to control the infection in this herd. As the causative agent of ano-vulvitis, the *Bacillus necrophorus,* is anaerobic, it is essential that the scabs be thoroughly removed before treatment is effective.

The writer would like to hear comments on this disorder and hopes that this article will be the means of interesting other veterinarians and induce them to write of their experiences with the disease.

THE INFECTIOUS ABORTION PROBLEM IN MICHIGAN*

There is universal desire among dairymen to own a herd free from abortion. One reason is the human health problem, the other reason is economic. Many municipalities restrict the sale of any but abortion free milk. The loss from abortion due to the anxiety of the public because of fear of undulant fever cannot be estimated. The loss in production can be estimated. Of this loss, about two-thirds is loss of milk production and the other third, loss in calf production.

In Michigan there are 850,000 dairy cattle two years old or over. 15% of these are infected with contagious abortion. On the basis of the Connecticut experiment which showed a loss of $44.00 per year per cow for reactors, the loss amounts to $5,500,000 a year.

John R. Mohler, chief of the Bureau of Animal Industry, states that abortion disease has doubled in ten years.

The loss due to the restriction on the sale of animals cannot be estimated. 18 states now limit the importation of abortion infected cattle and regulations in two others will go into effect in the course of a few weeks. It is probable that within two years, nearly all states will prohibit the importation of positive reactors to the agglutination test. Abortion affects commercial herds almost as much as it does the pure-bred herds.

There are two methods of control for contagious diseases—one, immunization of susceptible animals and the other, prevention of the dissemination of infected material. Bacterins, serums and vaccines have been used to produce immunity but there is no published records of a single herd in the United States that has been freed from abortion by this means, and there is not a state in the Union where an honest effort has been made by means of the agglutination test and the segregation of reactors, that does not have herds from which abortion disease has been eradicated by this means.

Not a single abortion vaccine containing live but non-virulant abortus organisms has been found on the market in Michigan. Some are claimed to be non-virulent but of those tested a single passage through guinea pigs was sufficient to make them infectious.

The cost of freeing a herd from abortion disease by testing and segregation may be expensive, but it is less expensive than it is not to free the herd of this disease.

The kind of segregation required in abortion disease depends upon many conditions and the local veterinary practitioner is the one to decide. Technical knowledge is needed to meet new problems and no hope is seen for the solution of the abortion problem except with an adequate veterinary service. The veterinary service already available, that is the local practitioners, are preferable to a state or a federal organization, and more economical.

* Notes from an address on The Infectious Abortion Problem in Michigan," by E. T. Hallman, Michigan State College; Eleventh Annual Veterinary Conference, University of Illinois, Urbana, Feb. 10-12, 1930.

Botulism in Horses

By J. S. FULTON, Saskatoon, Saskatchewan

THE disease so called "meningitis" of horses has been prevalent in Saskatchewan for many years, and although the writer was of the opinion that the condition was really botulism, not until recently has it been possible to demonstrate the causative organism.

Outbreaks have been investigated periodically during the past few years and in each instance feed has been examined for the presence of *C. botulinum* with negative results.

Several extensive outbreaks occurred late in the fall of 1929 at a time when many of the affected animals were running at pasture. Since infection from feed could be eliminated among the pastured animals attention was turned to the water supply, which was found to be lower than usual as a result of a particularly dry summer. The scarcity of water on many farms made it necessary to resort to old wells which had not, in some cases, been used for a number of years, and it was on these farms that losses were sustained.

Two of the four wells examined contained water which had a decidedly offensive odor, the water surface was covered with a heavy slime and decayed animal matter was found partly imbedded in the soil at the well bottom. The third well contained fairly clear water which was entirely devoid of odor although mice and gophers were found in the sand several inches below the surface of the well bottom. The last well examined had been cleaned out before my arrival and contained water which appeared fresh.

Information received from the farmers, watering stock at the four wells referred to, was to the effect that after using the water for several days the horses became sick, but since the water was not suspected as the cause, they continued to use it. In some cases the affected animals died within a week from the first watering, while in other cases two weeks elapsed before symptoms developed.

The mortality was high in all outbreaks investigated, between ninety and one hundred per cent.

After thoroughly agitating the water in the four wells examined, samples were collected for bacteriological examination. Part of the samples were heated to 80° C. for fifteen minutes and glucose broth inoculated. Cultures incubated at 37.5° C. aerobically proved sterile, while three out of the four incubated under anaerobic conditions showed growth in twenty-four hours and after several days the growth fell to the bottom leaving the media clear. Microscopic examination revealed the presence of a gram-positive organism indistinguishable from *C. botulinum*.

Two cultures were passed through a Berkefeld filter of N porosity and the filtrates which proved sterile were used for inoculation purposes. 0.25cc of filtrate No. 1, when given subcutaneously, produced typical symptoms of botulism in a fourteen hundred pound horse in two days. Filtrate No. 2 was found to be less toxic than No. 1, two doses totalling 1.5cc being required to produce symptoms in a horse weighing 1100 pounds. Both animals died as a result of the inoculations.

Guinea pigs when fed small quantities of the filtrate died in from two to four days as did guinea pigs given water direct from two of the wells.

The first noticeable symptoms in the experimentally produced cases were dullness, increased respiration, and loss of appetite. The head was slightly extended and the chin rested on the manger. As the disease progressed deglutition appeared impossible; partly chewed food falling from the mouth. When water was given the head was placed low in the vessel and when withdrawn water ran from the nostrils.

Difficulty was experienced in extending the front limbs and if walked over low objects the feet were lifted high. Vision became impaired and the animal appeared

afraid of familiar surroundings. The muscles of the neck became rigid, and at times the head was held slightly to one side.

Summary

From the results obtained, it would appear that the disease known as meningitis of horses in Saskatchewan, is identical to that type of forage poisoning described by American writers as due to *C. botulinum*.

The organism, isolated from well water when grown under suitable conditions, produced a toxin capable of producing the disease in healthy horses. To date the organism has not been typed.

PRISON AND FINES FOR OBSTRUCTING CATTLE TESTING

Four cattle owners of Butler County, Ohio, were found guilty and convicted recently in the Federal Court at Dayton, Ohio, for conspiracy to assault and forcibly oppose employees of the Bureau of Animal Industry, U. S. Department of Agriculture, who attempted to test herds of cattle for tuberculosis in accordance with the State law. The defendants, among others, had endeavored to hold up the area plan of tuberculin-testing of cattle in the county by force and violence, after an injunction issued by the local court had expired. The men carried a shotgun, a blacksnake whip, pitchforks, clubs, and stones.

After most of the herds in the county had been tested, cattle owners and breeders appealed to the local Federal and State authorities to send veterinarians to test the remaining 52 herds in order that the county might become classed as a modified-accredited area. The violence occurred on July 23, 1929, when Drs. Solon Gillen and Chas. S. Elliott endeavored to complete the test on one of the herds.

The case was tried before Judge Robert R. Nevin and the trial lasted three weeks. The four persons convicted were James N. Griffin, Wert A. Whipp, John A. Donson, and Valeria Donson. They face imprisonment in a Federal penitentiary and fines up to $10,000, but have appealed to a higher court.

MORE ERADICATION PLANS

Veterinarians and leaders in the live stock and dairy industries are reminded that the Bureau of Entomology, U. S. Department of Agriculture, published about four years ago, Department Bulletin 1369-D, "The Cattle Grubs or Ox Warbles, Their Biologies and Suggestions for Control," which treats in detail of the studies and experiments by the bureau dealing with this pest.

A small stock of this bulletin is still available for distribution to those who desire somewhat fuller information than is provided in the more recent popular-style, Farmers' Bulletin 1596-F, "Cattle Grubs or Heel Flies with Suggestions for Their Control," which is also obtainable on application to the Office of Information, U. S. Department of Agriculture.

Annual losses to the live stock industry caused by this pest, estimated at from $50,000,000 to $100,000,000, make advisable vigorous steps for its eradication. Control on individual farms is usually advisable and profitable, but the campaign is likely to be much more effective and profitable if waged on a large scale, with eradication over a considerable area. The entomologists anticipate that in the long run it will prove necessary to conduct eradication work by areas somewhat after the methods of tick eradication in the South.

The studies reported in this bulletin afford the facts on which local control campaigns may be projected. The authors point out the desirability of many large scale demonstrations of grub eradication. Copies may be obtained from the U. S. Department of Agriculture, Washington, D. C.

Achievements and Prospects in Tuberculosis Eradication

By ELMER LASH, Washington, D. C.

The campaign to eradicate tuberculosis in livestock has attained such large proportions that it is almost impossible to grasp it. The fact that more than 68,000,000 cooperative tests have been made means but little to the individual not accustomed to handling large figures. This should not be interpreted as meaning that there are 68,000,000 cattle under supervision, as a large number of these cattle have been tested more than one time. However, th amount of work performed by veterinarians engaged in cooperative tuberculosis eradication work can be better appreciated by viewing each test as representing an animal, as the procedure in a retest is the same as in the administration of the test for the first time. Viewed in this light, the cooperating veterinarians have tested enough cattle since 1917 to load a train which would reach half-way around the world.

The reactors obtained from these cooperative tests amount to, in round numbers, 1,800,000, or enough cattle to make a train load reaching from Washington, D. C., to New York City. Approximately one-third of the cattle in the United States are now under supervision for the eradication of tuberculosis. On February 1, 1930, there were 897 modified accredited counties, which is approximately 30% of all the counties in the United States. Bovine tuberculosis has been reduced 50% since 1917, and this reduction will, no doubt, continue at a satisfactory rate.

It was predicted by many at the beginning of the cooperative campaign that if all reacting cattle were slaughtered there would be a shortage of milk, which would result in serious injury to children because they would not be able to secure this necessary food. This prediction has proved to be erroneous, as the per capita milk consumption has increased since 1920 from 172 quarts to approximately 228 quarts in 1928, and at this time there is a large surplus of milk and butter in this country.

There is one part of the tuberculosis eradication campaign in which satisfactory progress is not being made; namely, the eradication of tuberculosis in poultry. This important branch of the livestock industry, which ranks third in importance, is valued at more than one billion dollars. The veterinarians engaged in testing cattle under the cooperative plan last year clinically inspected approximately 16,000,000 fowls, and found the disease on approximately 6% of the farms covered by their reports.

Splendid work has been done by these veterinarians in disseminating information to poultry raisers, but their work had been too limited to carry the project of eradicating tuberculosis from poultry flocks to a successful conclusion. The tuberculosis eradication campaign should, therefore, be extended so that avian tuberculosis may be banished at an early date from the one-half million infected premises located principally in the Corn Belt.

The need for the extension of this work is not only reflected in the reports of the field veterinarians, but also in the reports covering post-mortem inspection of poultry for canning purposes at middle western slaughtering establishments.

These reports indicate that a small percentage of tuberculosis is found even in the prime fowls, while a large percentage of the lower grade of fowls is extensively affected with this disease.

Some New Therapeutic Indications for Potassium Iodid

By ARTHUR H. BRYAN, University of Maryland, Baltimore, Maryland

IN THE December issue of VETERINARY MEDICINE there appears an article by Doctor Yutuc tending to show that potassium iodid is a failure in the treatment of epizootic lymphangitis, despite the favorable reports by Major Kelser. However there are so many valuable uses for the iodid preparations that one possible failure does not alter its general therapeutic utility. The article by Doctor Yutuc of Los Banas, P. I., prompted the writer to prepare this paper on the therapeutics of potassium iodid.

Every practicing veterinarian has some favorite drug, the therapeutic value of which, causes him to use it more than any other drug. Potassium iodid and the various iodid preparations come first in my estimation, for it is one of the few specifics in the veterinary pharmacopea. The action of the iodids in actinomycosis, botryomvcosis, sycosis, and teniasis, is well known, but there are dozens of other indications of importance from a veterinary therapeutic standpoint. The writer has observed over a period of years some remarkable results which can be obtained when potassium iodid is injected directly into any chronic indurative growth, or chronic swelling, the injections being made topically with a large sized hypodermic syringe, with dozens of punctures and the potassium iodid solution injected into all parts of the tumified area, until the whole area resembles a bloody sponge. Huge sternal bothryomycomata, knee hygromata, fistulae of the withers, poll evil, cysts, conjunctival tumors, etc., all readily responded to injections of potassium iodid. Five recent cases will serve to confirm the specificity of its use in the following widely diverse conditions.

Case No. 1.—Brindle cow age about 9 years; stabled on hard, rough cement floors, by continually slipping down, developed the largest hygroma, over the knee joint, I ever saw, larger in fact than a good sized pumpkin. The case was of course an inoperable one, and the animal was intensely lame. The cow was restrained, and a large puncture made with a trocar and canula, deep into the pendent, ventral part of the swelling, and about half a gallon of serous exudate was withdrawn, after which the skin sagged down like an empty sack. Experience has of course shown that this measure is only a temporary relief, for within a few hours the sack becomes fully distended again. Injections of a 15% to 20% solution of potassium iodid were made into all parts of the tumified area with a large-sized, hypodermic needle and a 20cc syringe, a pint of the solution being injected, which somewhat distended the area again. A few days later the owner complained, that the cow had become sick, and that the milk flow had fallen off considerably, the diagnosis being iodism. The swelling was just as large as before but was as hard as a rock, and extremely painful, instead of floculent, and painless as in the original hygromata. Again injections were resorted to, despite the concern of the owner, into all parts of the now hard indurated area. Two weeks after this treatment the tumor was reduced to a mere hazel nut sized hard knot, the swelling entirely lacking any serous fluid, the lameness gone, with the milk flow normal again. This cow was later shipped back to Georgia from whence my client obtained her, and two communications have been received, one from the local practitioner and the other from the owner, wanting to know what reduced the ugly hygromata.

Case No. 2.—Hard diffuse fibroid

growth over the shoulder of an old horse, the history of the case revealing that it originated as an ordinary collar boil, which untreated and continuously irritated developed into a most unsightly knotty swelling. Two separate potassium iodid injections reduced it entirely, with no evidence of recurrence to date.

Case No. 3.—Dog 11 years old, with a hard indurate fistulous swelling of the entire lower jaw and upper cervical region. The odor was bad, cervical lymph glands enlarged, the whole group of swellings making breathing and swallowing both

This is not the cow referred in case No. 1, but the knee hygromata are very similar to those in the case reported.

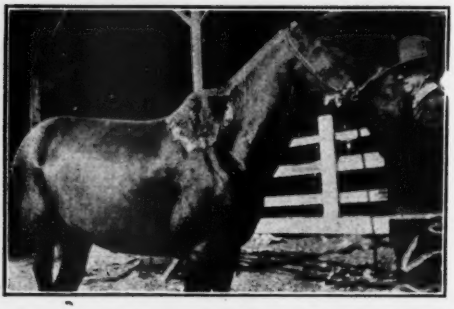
difficult and painful. Again operative procedure was contra-indicated owing to the diffuse nature and involvements of the swelling. External treatments by the owner proved valueless. Potassium iodid injections were made over the entire swollen area, and in four or five days the owner reported that the swelling was reduced. However two months later the swelling returned as bad as ever, with abcessed areas and new fistulous tracts. The owner stated that the dog had progressed splendidly after the original treatments, but that recently he had for some unknown reason started to scratch the area continuously, and had evidently reinfected the area. The dog being ugly and the owners indifferent, after-treatment which included bathing and painting with tincture of iodid had not been carried out. He was neglected in a dirty cellar. Again potassium iodid injections were resorted to. Five punctures with the full syringe were successful, but the sixth acted like a shot from a pistol; the dog gave one death howl, dropped backwards after an almost complete summersault dead. The case indicated the value of potassium iodid in these cases and also the need to exercise precautions on dogs.

Case No. 4.—Old bitch, bull terrier, which had never been pregnant but a history of the mammary glands periodically swelling up every year, and remaining so for several months. There was no evidence of any milk in the glands, and eventually by massage and hot applications the swellings subsided. However at the time the bitch was brought to me, the swelling had apparently become permanent, for no external treatment was effective in reducing it this time. The writer will not venture a diagnosis except to state the whole swelling was hard and fibrous and extended to all parts of the gland. The usual potassium iodid injections were employed but two days after the treatment, the owner, a lady of battleship proportions, and an extensive vocabulary, told me a few things not calculated to increase my self-esteem. The dog looked terrible, I must freely admit. The entire mammary gland had split open from one end to the other and the opening was at least an inch wide extending from one end to the other. Suturing was deemed a useless procedure, so a dusting powder of bismuth formic iodid was applied freely into the ugly wound. To my surprise, the wound healed up readily and the mammary swelling never reoccurred.

Case No. 5.—An ugly inoperable neoplasm diffuse hemhorragic and with an offensive odor; located around the vulva of a holstein cow, and contaminated by fecal material dropping over the surface of the tumor was brought to my attention. Vaginal examination revealed some meta-

static growth in the anterior vagina. A tenative diagnosis of carcinoma was made pending laboratory diagnosis. While awaiting the results from the laboratory I tried the effect of potassium iodid, injections of a 10-20% solution into all parts of the neoplasm. Dozens of punctures were made and the timor infiltrated with the potassium iodid solution, throughout the entire area including deep injections into the metastatic neoplasms just inside the vagina. Three days later the neoplasm had so far disappeared that I had difficulty in securing a section for further histo-pathological examination.

Following the diagnosis of malignant carcinomatosis of the vulva by the pathological department University of Maryland I tried further potassium iodid injections in the hope of breaking up the neoplasm entirely. In this instance I used a saturated solution of potassium iodid and it resulted in extensive necrosis all around the original tumified area, due undoubtedly to the escharotic effects of the too concentrated solution. Due to the laboratory diagnosis of malignant carcinomatosis, the owner refused to keep the cow and she was slaughtered two weeks later. A microscopic examination of sections taken at this time revealed almost no cancer cells.

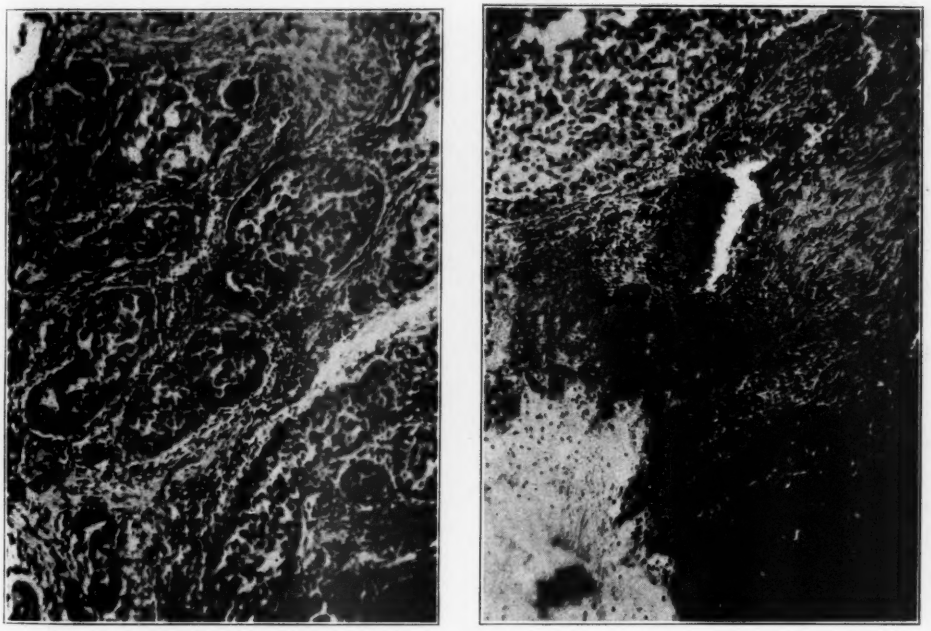


Perhaps we have approached the treatment of Fistula of the Withers from the wrong angle. All stress has been laid upon the attack upon the focus of infection and surgical measures have been selected solely upon the hope that they would afford drainage for the focus of infection. But three things about fistula of the withers are characteristic and set it apart from other local infection. The proliferative growth of connective tissue, the inaccessibility of the seat of the infection, and the chronicity of the active progress of the infection. Each of these characteristics are common to infection in other parts of the body but (except in poll-evil) not all three occur in the same process elsewhere. Why should the attack be waged so persistently against the seat of the infection. Abscesses occur and are walled off in the liver, the lungs, on the peritoneum and elsewhere, without materially affecting the health or usefulness of the animal. Perhaps if we attack the proliferative process we can accomplish as much for the animal in far less time without the surgical hazard that goes with enormous wounds and without the disagreeable task of dressing these wounds for weeks. Possibly if the tendency to proliferative process can be corrected, the greater reparative process in normal tissue will be able to wall off this deep seated abscess as abscesses are walled off in normal tissue elsewhere, and once walled off, its active process inhibited and the discharge of course, stopped, it need not concern us further. Injections of potassium iodid solution seem to offer a possibility of bringing about this result.

What has been said concerning fistula applies equally to poll-evil, except that surgical relief is easier to provide, less hazardous and convalescence shorter; so the advantages offered by potassium iodid injections are less conspicuous, but may be nevertheless real.

Two cases of fistula of the withers responded promptly to potassium iodid injections through small surgical openings, into the fistulous tracts, and with hypodermic punctures into all parts of the swellings.

While eighteen successful and recorded similar cases tend to prove the specificity of potassium iodid in the above conditions, one veterinarian stated in a recent communication, that while potassium iodid injections had proved effective elsewhere, the results obtained were not always as remarkable as those cited by me. This statement greatly interested the writer, and in an effort to seek a solution to the varying results obtained in different parts of the country, some soil samples were taken on a farm at Davidsonville, Md., owned by W. O. Tucker, where four tumorous growths occurring in horses and cattle had been successfully



These two microphotographs show the Histopathology of the ugly, soft, ulcerated Carcinomata surrounding the Vulva and Vagina of a Holstein cow before and after injection with dozens of punctures of potassium iodid into all parts of the neoplasm.

Fig. 1. A cross sectional cut through the vulval carcinomata showing typical active cancer cells with hyperchromatosis, the nuclei occupying the greater part of the inter cellular space. There are several mitotic figures further testifying to the malignant activity of the growth. Because of this morbid cellular activity as evidenced by the hyperchromatosis, with cells showing mitotic division, the case was diagnosed as a very malignant carcinoma, with a prognosis of rapid metastasis to other parts. (This proved correct.) The connective tissue stroma is largely replaced by epitheloidal cells and epithelial tissues characteristic of cellular epithelioma.

Fig. 2 shows a section of the same tumor which had been so reduced in size as to make it hard to find a piece for section following the injections of the potassium iodid. The owner thought the tumor had disappeared entirely, but small nodular masses near the original area showed that metastasis had already started. The injections caused the extensive degeneration and necrosis of the epithelial cells, and marked cellular atrophy on the left of the microphotograph. The potassium iodid evidently destroyed and disintegrated the tissues with which it penetrated to, bringing about cell shrinkage or necrosis with resorption of the detritus and broken down tissue structures. These two microphotographs are diametrically opposite; the one showing hyperplasia and marked cell activity, the other showing atrophy and necrosis. The potassium iodid injections brought about the changes.

treated with potassium iodid and where moreover, schirrous cord frequently followed castrations particularly in hogs, and

The condition would readily be pronounced incurable and yet it appears no more formidable than the knee hygromas on the cow referred to in case No. 1, in which potassium iodid injections were conspicuous and speedily successful.

local infections with subsequent induration were quite common. The soil samples from various pastures on the farm were collected and examined chemically for the presence of iodids in the soil. The soil was macerated with boiling hot water to which a little hydrochloric acid had been added. This boiling solution was passed through several times to bring down the soluble inorganic salts into the filtrate. This macerating and filtering process was very slow and took nearly two weeks. The filtrate was placed in a porcelain crucible, and burned in a electric furnace until all the soluble organic matter was burned and driven off. The crystaline residue, which represented the inorganic salt content of the soil, was dissolved in boiling water to which some calcium hydroxid was added. Then the starch-iodid, and chloroform tests were applied several times and showed negative to the presence of the iodid salts.

Mr. Korf, chief chemist, Baltimore City Health Department, with whom I worked on the experiment, stated that while these qualitative tests used were sufficiently sensitive to reasonably justify my statement about the absense of iodids in the samples, he felt that the problem would have been interesting to note, that the farmer in question has used some mineral feeds containing definite quantities of iodin salts, and that since then there has been no recurrence of these peculiar tumefactions in any of his live stock. This brings up an extremely worth while problem:

What is the relationship between iodin deficiency and the tendency toward indurative swellings and tumefactions?

In order to answer this question, the writer has turned to authorities in different parts of the world in an effort to throw some light upon the problem.

From a medical standpoint iodin deficiencies bear an inverse relationship to the incidence of goiter. In goiter districts only a portion of the population, animal and human becomes infected with the disease. In our non-goiter regions we still get a few cases of this condition despite the wealth of iodin in the drinking water. In these cases, in both animal and human, these seem to be an idio-

Conditions such as this are seldom amenable to surgical treatment. The percentages of cures from caustic applications and the actual cautery is low. Potassium iodid injections, to say the least, offer as much hope for recovery and less objectionable treatment.

pathic metabolic fault. In a stream near here, rendered absolutely free from iodin, the trout developed well marked colloid changes in all the thyroid tissues, and ultimately showed well marked tumors wherever thyroid tissue was normally

found. Goiters can be classified into three groups:

1.—Colloid. 2.—Adenoma (a) with hyperthyroidism (b) with hypothyroidism. 3.—Exophthalmic Goiter. The colloid goiter is very simple goiter and causes no inconvenience beyond mechanical effects when very large. The same is true with non-toxic adenoma without hyperthyroidism, but this type usually becomes toxic as it runs its course. The exophthalmic type is always toxic although its toxicity varies considerably. Pathologically, in the simple type there is a higher proportion of colloid material but no hyperplastic changes. In the toxic type there is not much colloid material but marked hyperplasia. The total iodin content of the entire gland is greater in the non-toxic than the toxic type. Therefore, the less iodin contained in the gland the greater is the degree of toxicity. To summarize:

Toxic Goiter—hyperplasia—less colloid, low iodin content per gram of gland.

Non-Toxic Goiter—greater iodin content (but still below normal) shows atrophy of the gland cells, and greatly increased colloid material. Therefore deficiency of iodin in the gland is in direct proportion to the hyperplasia.

Surgery is admittedly futile in most cases of melanosis. Wounds caused by the removal of tumors causing mechanical injury are notoriously "unhealthy"; that is, they are slow to heal and tissue prone to malignant degeneration. Potassium iodid injections in this condition offer not only the removal of the tumor causing mechanical injury or unsightliness, but the hope of arresting the formation of such tumors elsewhere.

Iodin Treatment of Goiter—In colloid goiter doses from two to four grains potassium iodid in humans and dogs, and 30 to 60 grains in horses and cattle will cause the colloid goiter to disappear if kept up for some time. We however prefer to rub iodin ointment into the skin overlying the gland every night for two

Chronic lymphangitis and lymph adenitis is another indication for injections or inunctions of potassium iodide. The case is inoperable and the only possible effective treatment will be that which will break up the exuberant granulation tissue or proliferative connective tissue tumefactions. Iodin injections first irritate the proliferations of connective tissue and the local swellings become larger, and more diffuse and painful; later, however, all this proliferative tissue will break down and be resolved and absorbed by the blood and lymph stream. Two treatments at least are necessary in these cases, and the punctured areas should be painted with full strength tincture of iodin. Small glandular enlargements can be successfully treated with iodin ointment. This illustration is of a case of glanders, but cases of lymphangitis with similar external lesions are seen.

or three months, acting by absorption. Potassium iodid injections in animals have been tried in goiterous regions since the publication of the article referred to above with surprisingly quick results, although in the young children living without goiterous regions they should be started on iodin medication in small weekly doses, and the same should apply to the live stock. In toxic goiter, iodin is not so useful and it is useless in adenoma. In exophthalmic goiter it appears to hasten the subsidence of the symptoms. Discontinuance of the iodin treatment often causes a decided exacerbation of the thyro-toxins.

Potassium Iodid in Human Syphilis—In tertiary syphilis, iodin is almost a specific in bringing about amelioration of the symptoms and the disappearance of the lesions. Yet, just as in the cases cited in this article, little is known of its action, and by what means the striking results are obtained. The iodids do not destroy the infecting organism (*Treponema pallida.*) It appears to counteract the diseased tissue, and therefore when given in conjunction with real germicidal agents such as arsenic and mercury, it lays the organism open to their action.

In other words, it breaks down the tissues that inclose the germs. This explains also why potassium iodid injections have been attended with such remarkable success when injected into actynomycotic, botryomycomata, and other tumified swellings particularly the fistulas.

Potassium Iodid in Glandular Tuberculosis—Potassium iodid is indicated and good results have been obtained. In other cases of tuberculosis it does more harm than good, for while it breaks down the tubercular nodules in a remarkable way, it also liberates the bacilli to do more pathological damage elsewhere.

Iodid Injections in Carcinoma—have been tried, but with uncertain results. Its effects are easily understood, the injections cause necrosis of the section of the tumor injected, which comes away as a slough or as a result of the induced inflammations, and is replaced by scar tissue. It has thus been able to remove large carcinomata by thus destroying them bit by bit, where the case is absolutely inoperable. Of course this is only temporary treatment as metastasis continues, and the tumor grows again.

Local Therapeutic Actions of the Iodid—In mild dilution iodin is a local irritant, and in concentrated form it is a caustic in addition to its antiseptic action. This is why it is used to cauterize the os uteri in contagious abortion in cattle, and in the human to cauterize the interior of the uterus in gonorrhea. Why not use it in septic metritis in cattle? Large gummatous tumors, extensive ulcerations, etc., disappear like magic following potassium iodid injections. It is very significant that no such effects are noted in primary and secondary syphilis where no extensive connective tissue proliferation occurs. This explains the reason for success, in treating all kinds of indurative enlargements. In the case of the cysts and chronic hygromata, the fluid is first drawn off, the injected iodids irritate the proliferated connective tissue, which later breaks down altogether and is dissolved and absorbed.

The writer has found that iodin and petrogen ointment is very effective in mastitis where the gland has become hard and lumpy following cases of acute interstitial mastitis. I first bathe the affected quarter with hot water in order to open the pores, and follow this with massage into the udder with the iodin and petrogen ointment, of course supplementing the treatment with the usual frequent milkings. I consider that iodin mastitis ointments are superior to all others where massage is indicated in any cases of mastitis. Captain F. C. Sager, V. C., in an article in the Veterinary Corps Bulletin states that potassium is a specific for sporotrichosis, and is valuable in purpura haemorrhagica and epizootic lymphangitis. Frohner in his text book on general surgery states that injections of iodin are indicated in shoe boils, carpal cysts

in cattle, capped hocks, and bursal hygromata, etc. Winslow, states that it may be injected into synovial sacks, joints, and abscess cavities to promote adhesive inflammation, and thus close cavities and prevents the accumulation of fluids in them. L. H. Ingrahm, late head of the science department of Baltimore City College considers that it is the ionized iodid ion, which when ionization occurs in the fluids is responsible for the breaking down of the connective tissue tumors, and causes the necrosis of the tissues which is subsequently resorbed by the blood stream.

Bernard E. Read, professor of pharmacology, Peking, Union Medical College, China, replying to my inquiries regarding the iodin therapeutics as used in China stated that Pen-T-Sao, recommends all of the medicinal algae in the treatment of goiter. A sea weed Kun Pu is recommended in all kinds of dropsies, and another seaweed containing iodin is used as a remedy for bronchiocele. In India, a seaweed Laminaria containing iodin is used extensively in skin diseases, and another iodin containing weed, bladder wrack, is used for removing glandular swelling, and as a massage for rheumatism. It is interesting to note that Reid Hund, found that the iodin of sea weeds is about one hundred times as active as potassium iodid.

Captain Weisman in the Veterinary Corps Bulletin prescribes in the early stages of periodic opthalmia the following:

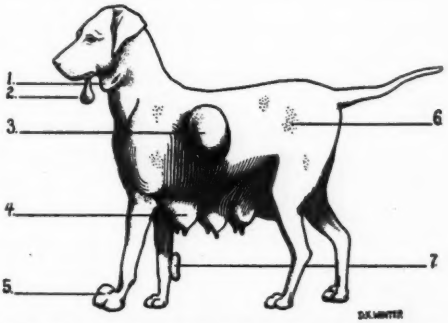
Cocain hydrochlorid	2	parts
Potassium iodid	2.5	parts
Glycerin	16	parts
Aqua distillata	100	parts

Instill a few drops into the conjunctival sac morning and evening. If the attack does not subside within a week or ten days he resorts to counter irritation using Lugols solution; injecting it in 2% strength into the orbital fat, repeating if necessary in a week.

Recently in canine distemper the most valuable alternative treatment has proved to be the various iodin preparations for internal administration. Calcium iodid in one-half to one grain doses, prescribed with other general remedies has given good results as has also iodized cod liver oil. Dean Brumley of Ohio includes iodin in his popular distemper formula.

Liquid or iodin ointments find many varied therapeutic uses where local inunction of iodin to bring about the resolution or resorption of inflammatory processes is indicated.

Frohner recommends iodin inunctions and irrigations with iodin in chronic lymphadenitis, lymphangitis, large hematoma, etc., with injections of 1:1000 or



Injections or inunctions of various iodin preparations have proved effective in the treatment of the following conditions in the dog: 1.—Goiter and Adenitis; 2.—Ranula or Salivary Cyst; 3.—Cystic Tumor or skin; 4.—Mammary Adenoma; 5.—Verruca interdigital; 6.—Ring worm; 7.—Connective tissue tumor. The diagram indicates the common location of proliferative connective tissue tumors in this animal.

1:2000 solution into the tendon sheath in cases of tendinous hygroma.

The writer following clinical observations over a number of years is convinced that potassium iodid injections are as specific for chronic enlargements, cystic tumors hygromata, etc., as well as for actinomycosis.

Acknowledgements—

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Mr. Ferdinand Korff, chief chemist, Baltimore city health department.
Late Dr. John W. Adams, professor of surgery, veterinary school, University of Pennsylvania.

FURUNCULOSIS IN A DOG

Subject: Four-year-old bull terrier.

General Condition: Very good.

History and clinical condition:—About nine months ago the feet swelled and soon serum with a little pus exuded from small pin-head openings. When squeezed, these bleed. The legs soon became affected up to the body, and later the body. At present the hair is off the legs almost entirely, and the skin is pinkish and presents a semi-scalded appearance. The small abscesses open themselves and exude a serum slightly mixed with pus. Several of them are discharging constantly. The feet and legs swell to twice the normal size and after soaking in some solution, recede to nearly normal for a time. The skin is gradually thickening.

This condition next appeared on the mouth and face and then all over the body. The skin on the body is affected in a little different manner. A swelling as large as a hazel nut will appear, soften and rupture and discharge a thick bloody pus. This opening heals readily and a scab forms and drops off, leaving an area on which hair is very slow to return. The dog's body is covered with these scars, likely one every two inches of the surface.

Microscopic findings: Several scrapings reveal no mange; but virulent streptococcus and staphylococcus.

Treatment: Autogenous bacterin (little or no benefit), S. T. 37, magnesium sulphate and other antiseptics; also painted with mercurochrome, etc. Some iodids have been given and some arsenates.

Results: Soaking seems to give some relief from the pain. It only holds it in check, does not improve any. The condition has remained stationary for the six weeks that we have had this dog under treatment.

Note: At least four or these cases have been seen here. The others were destroyed. —E. A. E., Washington.

Reply: Apparently this dog has what we term furunculosis. We see a similar condition fairly often in our clinic and our efforts at treatment frequently result exactly as in this case. I presume that the exact diagnosis would be just exactly what was found from the cultures, that is a virulent streptococcus infection.

We have had some cases in which autogenous bacterins seemed to do some good and in other cases, they did not. In some recent cases it appeared we had better results by using iodin plentifully in the form of a tincture, than we had with anything else.

In checking up on this condition with other small animal practitioners, I find that it is always persistent and sometimes lasts for years and sometimes it is impossible to cure.—H. J. M.

CHLORAL NARCOSIS IN THE DOG

Please give me the dose of chloral hydrate in water per rectum for dogs to put them to sleep. I must do my work without skilled assistants and anesthesia produced in this way would be very nice for me.—N. J. T., Tenn.

Reply: Doctor Dykstra of Kansas has done most of the work on this preparation and his doses are: One dram chloral hydrate to one ounce cold water for each 25 pounds weight.—M.

CONGENITAL MALFORMATION AND INBREEDING

I wish to have some information about a Peke dog, male. He has the following symptoms. The dog seems to be double jointed at the hock and when walking, the hock turns inward. Seemingly, he has had this trouble since birth.

I would like to know whether this could be due to inbreeding. This is the only one of a litter of five that shows this condition. —A. S. E., Ohio.

Reply: Presumably this is simply a case where nature has gone wrong, and the trouble is congenital. Whether this is due to inbreeding is a hard question to answer. Personally, I do not believe that it is. We have cases of congenital malformations occasionally and I have never been able to see any connection between these and in-

breeding. Of course, anything that goes wrong is laid to inbreeding, and yet you know a great many of our best animals hav been produced in this way.—M.

DESTROYING ANIMALS PAINLESSLY

The article in the March issue (page 93) on Destroying Animals, by E. T. Baker, is very interesting, but I disagree with the statement that the use of strychnin is a humane method of destroying any animal. It causes a painful agonizing death.

For me, the method of choice in destroying dogs and cats is to pour a two dram vial of diluted prusic or hydrocyanic acid into the animal's mouth. It is all I ever use to destroy small animals. It kills by paralyzing the lungs and heart and consciousness is quickly lost.

Yorkton, Sask. T. V. Simpson.

VACCINATION AND AGALACTIA

Will the vaccination of a sow with suckling pigs cause agalactia?—L. A., Illinois.

Reply: It is assumed that by vaccination you mean the injection of anti-hog cholera serum or the simultaneous injection of serum and virus.

The injection of anti-hog cholera serum alone produces only a passive immunity and does not cause a reaction; therefore, the injection of serum alone would have no influence on lactation. The simultaneous administration of serum and virus into a susceptible hog produces a reaction and there may be some variations in the functions of different organs and glands. However, agalactia has not occurred as a result of the use of serum and virus or at least no such cases have been reported. If there is a severe reaction and a high temperature following the use of serum and virus there will be a diminution of milk.

If you have any clinical data on this problem, we shall be glad to have it.—A. T. K.

RESOLUTION OF ALABAMA VETERINARY MEDICAL ASSOCIATION

1. That the head or director of milk inspection of the State Health Department should be a licensed graduate veterinarian.

2. That the director of meat inspection of the State Health Department should be a licensed graduate veterinarian.

3. That all veterinarians employed in meat and milk inspection shall be graduate licensed veterinarians.

4. That all meat and milk inspection done in Alabama shall be done by licensed graduate veterinarians.

5. That extension agricultural demonstrators and vocational teachers and teachers of Animal Industry in schools and colleges shall confine their work; (a) To first aid work for farm or domesticated animals; (b) To teaching or instructions in hygiene and sanitation; (c) To physiology and exterior and gross anatomy.

6. That extension and vocational agricultural teachers shall not practice veterinary medicine and surgery.

7. That all tests for diseases of animals including poultry shall be done by graduate licensed veterinarians or under their supervision.

8. That all animal and research work in animal diseases shall be under the direct supervision of, or shall be done by graduate licensed veterinarians.

Auburn, Ala. W. A. Cary, Secretary.

In recent years about 70,000,000 animals have been slaughtered annually in establishments where Federal Meat Inspection is maintained and fewer than two per cent of the carcasses have been condemned in whole or part because of diseased condition. However, most losses from livestock diseases occur on farms and young animals are the principal victims.—J. R. Mohler.

The Control of Pullorum Disease

By C. A. BRANDLY, Manhattan, Kansas
Poultry Bacteriologist, Kansas Agricultural Experiment Station

THE 1924 Yearbook of the United States Department of Agriculture shows a farm poultry population of 372,825,264 birds on the 5,852,000 farms in the country. This poultry represents a monetary value of $373,394,057. These figures taken from the 1920 census indicate an increase of 26% over the number of poultry on farms in 1910. Later complete figures are not available, but it is apparent that the poultry industry is continuing a phenomenal growth which may not reach its peak for several decades.

With the enormous increase in the numbers and values of poultry, the problem of disease assumes greater significance. Of the diseases affecting chickens as well as other domestic fowl, no disease is of greater importance today than pullorum disease (bacillary white diarrhea). It has been aptly stated that "this scourge not only strikes at the poultry industry at its fountain-head, but it is a menace throughout the industry's cycle." Not only is the mortality from this disease in chicks from reactor hens 40% greater than in those from non-reacting hens, but the ability of the infected chicks, which survive the disease, to grow and develop is seriously impaired. These survivors can be considered only a loss because they are always a potential source of danger as carriers of the infection.

Experimentally, the egg-production of reacting hens has been shown to be 24% lower than in non-reacting hens.[1] In certain investigations of farm flocks, fertility has been found to be 20% lower than in healthy birds, and hatchability had decreased 12%.

With an average mature flock infection of 25%, which is a conservative estimate in states where pullorum disease control has not been given particular emphasis and attention, the losses due to infertility, poor hatchability and death alone were found to be eleven cents for each healthy chick, i. e., in free flocks the cost of producing one chick was eleven cents less than in breeding flocks harboring 25% reacting hens. In a state with a poultry population equalling that of Indiana (U. S. D. A. Yearbook 1924) the annual loss in replacing one-third of the farm flock would be $62,233.60.

This does not include the less easily estimated, but obviously tremendous loss, incurring from impairment of production of the infected hen and the interference with growth of the chick.

From an economic standpoint, it is evident that the widespread application of disease control procedures, including rational regulatory measures are essential. In the control of pullorum disease a consideration of the following factors should suggest essential procedures and facts that apply particularly to this disease: (1) diagnosis, (2) epidemiology, (3) prevention and eradication.

I. Diagnosis

On appearance of the disease in chicks, diagnosis is chiefly dependent on post mortem examination of a representative number of typical specimens together with bacteriological examination. An early diagnosis is an important factor in protecting the flock owner and in determining the source of the infection.

Where there are available chicks that show lesions or changes characteristic of the disease, and the history does not exclude the possibility of pullorum disease, a diagnosis can sometimes be made by the veterinarian in the field. A diagnosis may be made in those chicks five to

[1] Asmundson, V. S., and Biely, Jacob: Effect of Bacillary White Diarrhea Infection on Egg Production. Poultry Science, Vol. VII, pp. 293-299.

fourteen days of age showing lung lesions in the form of whitish to yellowish necrotic spots, foci or nodules. Although some investigators[2] consider certain changes of the heart and liver alone of sufficient diagnostic significance. However, many losses may occur in acute outbreaks without lesions extensive or characteristic enough to allow a diagnosis except by resorting to bacteriological examination. Furthermore, atypical cases with lesions resembling those of vitamin A deficiency are also encountered to complicate the problem of diagnosis. These cases are characterized by a marked dropsy and distension of the body cavities; the organs and tissues are greatly swollen and edematous; and a dark fluid diarrhea is usually present.

To substantiate a field diagnosis and to prevent overlooking the disease in suspicious cases, early shipment of chicks to a diagnostic laboratory is important.

In older birds the diagnosis is usually made by means of the agglutination test although the usual chronic form in hens manifests changes of the ovary that on autopsy are quite characteristic of pullorum infection. Discolored, misshapen and cystic ovaries accompanied by various inflammatory changes are very common. In mature male birds, chronic inflammation of the pericardium is the most constant lesion. The pullorum organism, *S. pullorum,* often must be isolated from these lesions in order to confirm a diagnosis, although the changes caused, by *S. pullorum* infection of the ovary, are more constant and typical than those accompanying any other infection of this organ.

The feeding of unsterilized infertile or dead embryo eggs from the incubator occasionally results in acute outbreaks of pullorum disease in mature birds. The symptoms and lesions resemble very closely those of fowl typhoid. The effect on agglutinin titre of the blood and its diagnostic significance cannot be overlooked when rations containing pullorum infected eggs are fed continuously, particularly if they have not been properly sterilized.

The ready application of the agglutination test for the diagnosis and detection of carriers of pullorum disease provides the basis of our present-day control measures. Many veterinarians in the field are carrying on this diagnostic procedure, thus making readily available an indispensable service which the intelligent poultryman will not overlook.

The pullorin, intradermal or wattle test depends on a reaction and swelling following injection of a substance prepared from the pollorum organism. Extensive application of various types of "pullorin" indicates that this test in its present state of development is not a satisfactory substitute for the agglutination test and consequently it cannot be used to the mutual advantage of the veterinarian and poultryman.

II. Epidemiology

Before Rettger in 1899 discovered *Salmonella pullorum,* the germ or organism which causes pullorum disease, the disease was considered infectious and readily transmissible from chick to chick.

The infectivity of the body excretions as well as the cycle of infection through the hen and the chick have long been recognized but not until the recent great development of commercial incubation has the significance of air borne infection been realized.

At the Kansas Station it has been determined that approximately 7% of the eggs laid by a flock of hens reacting to the agglutination test for pullorum disease contain *S. pullorum.* Chick embryos in infected eggs may die at various stages of development, some survive and hatch. These chicks provide a source of infection for many other chicks, experimental results indicating that one diseased chick may, under favorable conditions, infect 40 healthy ones. Large numbers of pullorum organisms are present in the fluid

[2] Doyle, L. P., and Mathews, F. P.: The Pathology of Bacillary White Diarrhea in Chicks. Bul. No. 323, July 1928, Purdue Univ. Agr. Exp. Sta.

surrounding the chick embryos of infected eggs and on breaking of shell and drying these organisms readily pass off on the infected down into the air of the incubator. Inhalation of the disease-bearing down results in infection of healthy chicks near or at a considerable distance from the infected individual, depending on various incubation conditions. On removal from the incubator, infected chicks may come in contact with many healthy ones or the disease may be transmitted indirectly through the medium of contaminated equipment, feed or water. The chick is apparently not highly susceptible to acute pullorum disease after it is four days of age.

Uncooked infertile or dead germ eggs fed to older birds are not infrequently the source of acute outbreaks of a septicemic nature. Another source of infection and possible sensitization with subsequent reaction to the agglutination test is the inclusion of incompletely sterilized infertile eggs in home mixed or commercial mashes.

Occasionally local infection in the hen may become generalized with the result that losses may occur from acute pullorum infection with symptoms resembling fowl typhoid.

III. Prevention and Eradication

Disease prevention and control measures are essentially related, the adequacy of the former largely determining the accomplishment of the latter. Some diseases can be controlled successfully only by eradicating them. Complete eradication of some diseases, however, is frequently impractical or economically impossible.

Pullorum disease can be prevented and eradicated in the individual flock by carrying out definite control measures that have already proved successful. The complete eradication of this scourge will depend upon the full and sustained cooperation of the various agencies concerned. A few of the present conditions and facts that must be considered may be mentioned.

Experience has shown that no effective methods or measures have been developed to control pullorum disease when the infection gains entrance to a brood of young chicks. However, the disease may be effectively combatted by attacking it at its weakest point—a condition of chronic localized infection in the laying hen.

The agglutination test applied to all the birds on the premises at successive intervals of one to three months is now recommended in order to free the flock of reacting birds in a minimum time. Ordinary farm flocks harboring over 25% infection on the original test should be disposed of and replaced with known tested stock or by eggs or chicks from known tested origin. On passing several successive non-reacting tests within a six-month period, annual testing of all the birds on the premises is recommended to keep them disease free. In the testing program the following specific points may be emphasized in that they frequently influence or determine its ultimate success.

1. Errors due to improper and careless banding and loss of bands.
2. Errors due to careless labeling or numbering of blood samples.
3. Errors due to poor and inaccurate records.
4. Failure to remove all reacting birds immediately on being reported regardless of their value.
5. Failure to dispose of reactors for food purposes only.
6. Failure to test 100% of the birds on the premises.
7. Failure to clean and disinfect properly after removal of reactors.
8. Failure to quarantine and test all new stock and those birds returned to the flock from shows or fairs.
9. Failure to dispose of all feathers and offal of birds slaughtered, by burning or, of all carcasses in losses due to any cause.

10. The feeding of unsterilized, infertile or dead germ eggs.

11. The hatching of eggs from reacting hens in the same incubator with those from healthy hens.

12. Contact of healthy chicks and those from untested sources during brooding and shipment.

Some of the considerations mentioned are closely related to others. Most of them do not need explanation but some will be considered both directly and indirectly as they relate to the control program. Banding, numbering of vials and records require meticulous care to prevent confusion and errors. A very satisfactory record sheet is one that was originally described by Wilson[3]. This form, if used during taking of blood samples and labelling of vials, prevents duplication of numbers and other errors. In rechecking bands or vials and in recording reactors, it saves much time and greatly minimizes mistakes. In those states having no regulatory provisions for disposition of reactors according to definite procedures the affixing of an affidavit to attest disposition of reactors by the owner is convenient and effective. This method of encouraging prompt disposition of reactors is particularly desirable even in local restricted testing of flocks and affords mutual protection to the flock owner, the veterinarian conducting the tests and the hatcheryman, if the flock is a source of egg supply for a hatchery.

Previous mention has been made of the fact that the pullorin, intradermal or wattle test in its present state is not a satisfactory substitute for the agglutination test and it therefore will not be given further consideration.[4]

The agglutination tests widely used in testing for pullorum infected birds are the tube or slow test and the plate or rapid test. The principal of both is the same and each has certain advantages over the other. The chief advantages of the rapid test over the tube are:

1. Freedom from errors due to growth of contaminating organisms.
2. Applicability to testing of cloudy and hemolyzed sera.
3. Saving of space and equipment.
4. Quick determination of test results.

The tube test possesses the following chief advantages:

1. Probable greater accuracy in low titer samples of sera.
2. Greater stability of antigen.

The plate or rapid test has found particular favor among veterinarians doing agglutination testing because of its adaptability to conditions where space and equipment are at a minimum. This test must not, however, be considered so simple that it can be conducted without a great deal of care and considerable experience.

Our present knowledge of the test indicates that a source of uniform and dependable fresh antigen is one of the chief considerations in its accurate application. Frequent checking of the antigen during use is necessary. Duplicate tests of a representative number of samples tested each day may be conducted by the tube method. However, a simpler check on the rapid test antigen may be conducted by keeping on hand properly preserved samples of known positive pullorum and negative pullorum serum. Five per cent chloroform or 0.5 per cent chinosol are satisfactory preservatives for the known sera.

The simplified whole blood agglutination test recently described by Bunyea *et al*[5] when compared to the older agglutination methods in a considerable number of tests conducted at the Kansas Experiment Station did not give sufficiently

[3] Wilson, I. D.: The Result of Three Years' Work in White Diarrhea Infection Control in Virginia. Journ. A. V. M. A., Vol. LXXIV, N. S., Vol. 27, No. 4, March 1929, pp. 439-444.

[4] Bushnell, L. D., and Brandly, C. A.: A Comparison of the Pullorin Reaction and the Agglutination Test for Bacillary White Diarrhea. Jour. A. V. M. A., Vol. LXXIV, N. S. 27, No. 3, Feb. 1929, pp. 364-371.

[5] Bunyea, Hubert, Hall, W. J., and Dorset, M.: A Simplified Agglutination Test for Pullorum Disease. Journ. A. V. M. A., Vol. LXXV, N. S. 28, No. 4, Oct. 1929, pp. 408-410.

close correlation to indicate that it can be used to advantage in its present state.

Among the chief problems of incubation in its current aspects, is elimination of infection at the source by incubating only eggs from blood tested flocks. If this is accomplished, supplementary disease-dissemination control measures are greatly simplified. The most important of these latter measures are the maintenance of a high relative humidity in the incubator air and, incubator disinfection with formaldehyde gas.

Properly constructed buildings for housing the incubator are essential to maintain proper sanitation. Proper ventilation is important in order to prevent contamination of room and incubator air as well as to prevent possible dissemination of infection to outside agencies or flocks in close proximity to the building.

A wet bulb thermometer reading 84-86 between hatches and of 88-90 during hatching has been found to increase the vigor and size of the chicks over those incubated and hatched in a drier atmosphere. Of equal significance in high relative humidity of the incubator air is the control of chick down circulation in the machine. Transmission of pullorum infection, by dry contaminated down in the air of the incubator, has been stressed under means of dissemination. A high moisture content of the air prevents drying of the down to the extent that it will readily float in the air. Also by increasing the amount of moisture in the air formaldehyde gas fumigation becomes more effective.

For the fumigation of the incubator room as well as the incubator before, during and after hatching, formaldehyde gas is a satisfactory agent. The gas is generated by mixing commercial formalin (formaldehyde gas in water) and potassium permanganate. These materials are mixed together in an earthenware or enameled vessel and introduced into the incubator. By special equipment the gas may be generated outside of the forced draft machine and introduced into the machine through the air intake. Thirty-five cubic centimeters of commercial formalin and 17.5 grams of potassium permanganate are recommended[6] for each 100 cubic feet of incubator space.

Most of the gas is liberated within five minutes after mixing the ingredients, but the incubator should not be opened for at least ten minutes. (The ports need not be closed).

Fumigation between hatches and at three successive eight-hour intervals previous to and including the beginning of the hatching period have given remarkable results in controlling the spread of pullorum infection in machines known to harbor infected eggs from reactor flocks.

The hatchability of eggs does not seem to be affected by fumigating them three times. No harmful effect on the newly hatched chick seems to result from formaldehyde fumigation carried out as suggested particularly as removal of all "dry" chicks before each fumigation exposes them to only one fumigation. Gwatkin[7] reported that he was able to fumigate an incubator of the still-air type six or eight times without apparent injury to the hatchability of the eggs. He found that 2 c.c. of formalin and 0.66 grams of potassium permanganate crystals per cubic foot were necessary to kill all *S. pullorum* organisms and that the incubator must be sealed and kept closed for one hour.

Dead chicks and embryos, shells, and all incubator and hatchery refuse should be disposed of only by burning in a closed receptacle. Infertile or dead germ eggs, a potential source of pullorum disease spread, can safely be used for feeding poultry or other animals only after they have been boiled for five minutes or rendered sterile by other equally effective heat sterilization measures.

[6] Bushnell, L. D., Payne, L. F., and Coon, C. J.: Fumigation of Forced Draft Incubators, Jour. A. V. M. A., Vol. LXXV, N. S. 28, No. 5, Nov. 1929, pp. 611-625.

[7] Gwatkin, R.: Some Experiments on the Disinfection of Eggs and Incubators. Ont. Vet. Coll. Rpt., 1926, pp. 58-65.

In brooding and shipment, sanitation is as essential as in the preceding phases of production. Regular cleaning and disinfection of the brooder and equipment is sometimes neglected with serious results. Only new, clean shipping containers may be used with safety.

Conclusion

The nature of pullorum disease points to the feasibility of its eventual eradication by proper sustained preventive and control measures. The individual flock owner, on freeing his flock of the disease by measures that have already proved successful, must keep them healthy by selecting only known disease-free stock and eggs, and, by rigid quarantine measures for new birds or those returned to the flock. The hatcheryman realizing that efficient incubation, the production of healthy vigorous chicks and their profitable distribution cannot condone the menace of this disease will speed its eradication by marketing only healthy unexposed chicks from clean flocks. The veterinarian, admirably fitted by his fundamental scientific and professional training may, by his interest and study of the disease control problem in its specific application and, by providing essential disease elimination service, serve private and regulatory agencies in the ultimate accomplishment of eradication of this dread scourge.

COWHERB INJURIOUS TO CHICKENS

A correspondent writes:

"I am sending a sample of some chick feed. Our chicks are dying and I suspect it is in the feed. Would you kindly examine the sample for molds? If you do not do this kind of work, kindly let me know at once; also advise to whom it should be sent."

Upon examination of the feed, we do not find any molds, but do find that there is some finely ground cowherb, *Saponaria Vaccaria,* which is more or less toxic. There is also a little other material in it, such as lamb's quarter, *chenopodium.* While it is not poisonous, it is found that chicks will not thrive on seed of this plant. The trouble is probably due to the small quantity of cowherb.

Screenings ground up fine and made into chick feed are fine provided such plants as cowherb and corn cockle are not in the material.

L. H. Pammel.

POISONOUS FUNGI ON BARLEY

Some years there is much complaint about the feeding of barley and wheat to hogs. The following is an item which appeared in the daily press recently:

"West Branch.—The farmers hereabouts are complaining that the hogs will not eat this year's crop of barley. The grain is bitter and the hogs refuse to eat it. When forced to consume the barley, vomiting results.

"It is said that 40 per cent more barley was raised in Iowa this year than usual, and the farmers in this vicinity raised much more than is their usual custom, depending upon it to solve the feeding problem until the new corn is ready."

Several fungi cause this bitter taste, among them species of Fusarium which produces a reddish mold in and on the kernels of barley. There was much of this in the field before the grain was cut this year (1929). The wet weather during harvest time caused the fungus to spread to other kernels.

L. H. Pammel.

VACCINATION OF PIGS

Everything considered, six weeks is about the best age to vaccinate young pigs. At this age the immunity the little fellows have acquired from the mother's milk is waning, and parasites have not yet pulled them down. In addition to this, they are easier to handle and need less serum and consequently it costs less at this time than later. The two most important enemies to vaccination are a low grade virus and careless technic.

Ithaca, N. Y. J. W. Benner.

Reviews and Abstracts

Vaccination for the Prevention of Fowl Pox

The presence of fowl pox each fall in old and established poultry communities has come to be expected. In fact, diseased birds have often been introduced in flocks to cause an early infection so that the disease would run its course while the birds were still on the range. The need for a more definite method of immunization led Gildow[1] and Bottorff, in 1926, to study skin vaccinations for fowl pox in poultry with a non-attenuated virus. The object was to determine at what age fowls may be successfully immunized, the length of time immunity is retained, the age to vaccinate, the number of follicles to inoculate, and the effect of vaccination sickness on birds infected in a various number of follicles at several ages.

The vaccine was prepared by inoculating the combs of healthy ten-week old Leghorn cockerels with fowl pox virus and 21 days later, removing the scabs and drying them. When the virus was to be used, the scabs were finely powdered and the material suspended in sterile water in the proportion of one gram of the powder to 100cc of water. The suspension was used immediately. It cannot be held because putrefaction develops in it rapidly.

In vaccinating, feathers were plucked from the lateral surface of the middle tibial region and vaccine was applied with a clipped camel's hair brush. Vaccine was applied in 3, 6, 9 and 12 follicles. There was no difference in the type of immunity produced by the larger doses, but the larger the number of follicles inoculated, the severer the reaction and the greater loss in egg production and the less gain in weight. At the end of ten days, regardless of the number of follicles inoculated, a dark scab had developed at the point of vaccination and in 5 to 50% of the birds, small lesions developed on the comb.

The duration of immunity was tested at various times up to 17½ months after vaccination, and was complete on all tests. Vaccinated birds were placed with susceptible birds four months after vaccination and did not communicate the disease.

As has been shown in previous experiments, it was found best to vaccinate birds at 2½ to 4½ months of age and in the early fall before cold weather sets in. Birds that were vaccinated after laying commenced, showed a lessening in production of eggs for a month following. Adult birds vaccinated during the laying season stopped laying and went into a molt.

Vaccine in this experiment was used in more than 17,000 birds in commercial flocks. In these there appeared to be a considerable difference in the percentage of "takes." In some flocks there was 100% of "takes," in others as low as 20. The breed appeared to have something to do with this.

It will be recalled that in California it was found that the inoculation of a single follicle was sufficient to bring about immunity to fowl pox and resulted in a minimum disturbance to the health of the bird.

All things considered the method of follicle vaccination of birds for the prevention of fowl pox seems inferior to intradermal vaccination with the use of the scalpel as described by the Oregon Agricultural Experiment Station (VETERINARY MEDICINE, March 1930, page 101).

[1] Gildow, E. M., and C. A. Bottorff; Vaccination for the Prevention of Fowl Pox; Agricultural Experiment Station, University of New Hampshire Circular No. 30, November 1929.

Inconsistencies in Agglutination Reactions for Pullorum Disease

Kernkamp[2] of the Minnesota Agricultural Experiment Station reports an investigation to determine the dependability of the agglutination test in the diagnosis of pullorum disease (bacillary white diarrhea) in adult fowl.

His findings in the main confirm those of the earlier investigations of Beach in California and Beach in Wisconsin; the

[2] Kernkamp, H. C. H.; The Results of Repeated Testing by the Agglutination Method for the Detection of Bacillary White Diarrhea in Adult Chickens; *The Cornell Veterinarian*, Vol. XIX, No. 4, October, 1929.

consistent reactions in the Wisconsin experiment being 56% of the whole and in the Minnesota experiment, 50%. 27% of the total positive reactions were consistently positive in the Wisconsin experiment, and 43% were consistently positive in the Minnesota experiment, while only 20% possessed this characteristic in the California experiment.

In the negative reactions there was far more variation, the California experiment showing 90% of consistency, the Wisconsin 17% and the Minnesota experiment only 6.5%.

It is again brought out by this investigation as it was by both the previous investigations referred to, that attempts to accredit flocks of poultry as being free from pullorum disease on a basis of the agglutination test are premature at this time, and that advertisements of hatching eggs or day old chicks as being from accredited flocks or being "certified" as free from pullorum disease is misleading.

As in the case of the Wisconsin experiment, postmortem lesions and bacteriological findings bore a minor agreement with the reaction of the agglutination test. In the author's words: "The inference that a negative agglutination reaction is positive assurance a bird is free from the infection of bacillary white diarrhea would be accepting a condition which is known not to be a fact."

It will be recalled that Beach of Wisconsin as a result of his investigation which was fully reported in these pages, was led to the conclusion that the use of the agglutination test does not, at the present time, offer a practical means of controlling pullorum disease under average conditions in Wisconsin.

While Kernkamp does not state his conclusions as to the practicability in Minnesota, one is led from his report to the conclusion that the conditions in that state are not different from what Beach found in Wisconsin. The author gives the following conclusions as a result of his investigation:

Consecutive or repeated testing of adult birds by the agglutination method shows that in some birds the test will always be negative, in others it will always be positive, and in still others the reactions will be inconsistent or vary. For example, the first two or more tests will be negative and then a positive reaction will occur at one or more test periods, which in turn will be followed by negative reactions. Many other combinations could be cited, but the above example is illustrative of what is meant by inconsistent or varying reactions.

It is concluded that to assume because a fowl does not react to two or more successive agglutination tests performed at intervals of approximately 30 days, it is free from the infection of bacillary white diarrhea, might be assuming something not to be the fact. It has been found that from birds which have not reacted at two or more tests, pure cultures of *S. pullorum* have been isolated. Lesions characteristic of the disease in adults have been observed in negative reacting birds. This should not be construed as a condemnation of the test or the results obtained through its use, since the number not showing evidence of the disease and in which the tests were always negative is far greater than the number showing evidence of the disease. In other words, a flock of consistent negative reacting birds is desirable.

All reacting adult birds are not necessarily affected with bacillary white diarrhea. This conclusion is reached subsequent to finding that nearly 25% of the birds in which consecutive positive reactions occurred did not show gross evidence of the disease and the bacteriological examination failed to show that *S. pullorum* was involved.

Whereas a large percentage, 68%, of the birds in one series giving a suspicious reaction on the first test were found not to be affected subsequent to pathological and bacteriological examination, it is nevertheless believed inadvisable to pass such birds as healthy or free from the disease.

Iodin Tolerance of Farm Animals

In view of the increasing use of iodin as one of the mineral supplements in the feed of farm animals, Orr and associates[3] undertook an experiment to determine the tolerance of different species for this mineral.

Increasing doses of iodin were given to calves, pigs, sheep and poultry, over a period of several months, control animals being kept in each case on the same ration, but without the addition of iodin, and under the same conditions.

Calves.—It was possible to dose a calf with as much as 5.0 grams of iodin a day. No abnormal symptoms were observed until a dose of 3.5 grams a day was reached. At this point, in one calf, the hair became patchy on one shoulder; thereafter, at a dose of 3.75 grams, the two experimental animals became affected with dandruff and hair continued to fall out. The weight increase was not so well maintained and running at the nose was apparent in one case. No loosening of teeth or watering of the eyes was observed in either of the animals. On discontinuing the iodin after a daily dosage of 4.25 grams had been reached these two animals quickly gained weight and recovered their usual condition. The original control calf which subsequently was given iodin did not show any of the symptoms above noted except running at the nose. All animals showed a strong disinclination to take a daily dosage above four grams.

Pigs.– It was possible to give a pig in its daily ration as much as 5.75 grams of iodin. There were no untoward symptoms of any kind noted beyond a disinclination to eat food to which the higher doses of iodin had been added. The increases in weight were normal, one experimental pig gaining more weight than the better of the two controls.

Sheep.—It was possible to give daily to sheep 0.35 grams iodin in the food. Attempts to give a daily dose higher than this failed. The highest continued dose which sheep will comfortably withstand was 0.3 gram. This dose was fed continuously for a period of 62 days. No signs of iodism were apparent, though, at the end of the experiment, the two animals getting high iodin were not in such good condition as the controls.

Poultry.—Increasing doses of iodin up to an amount of 0.30 gram daily over a period of 90 days did not produce any ill effects on poultry. At a dose of 0.31 gram daily one bird showed slight watering of the eyes while another molted more rapidly than is usual.

[3] Orr, J. B., A. Crichton and W. Middleton, Rowett Research Institute, Aberdeen, Scotland; A Note on the Toleration of Farm Animals for High Doses of Iodin; *The Veterinary Record*, Vol. IX, No. 48, November 30, 1929.

Rickettsia Ruminantium[4]

Heartwater is a disease occurring in cattle, sheep and goats and is transmitted by a tick.

On the basis of our present knowledge it is one of a group of diseases (typhus, deer-fly fever, etc.) which occurs in man and animals to which the name *Rickettsia* has been given and in which small bacterium like intracellular organisms are found in various organs. Heartwater in cattle, sheep and goats is scientifically known as *Rickettsia ruminantium.*

The goat is most susceptible, then sheep; cattle are less susceptible than sheep. The Persian sheep, although susceptible, appears to have some resistance.

It is known to be fairly prevalent in areas where the ticks responsible for the transmission of the disease breed freely; the class of animal amongst which losses are most severe is that born and reared on non-infected grazing and removed to a heartwater infected area; in such the mortality in cattle may amount to at least 20%; in sheep and goats the losses may be still greater, viz.: 50 to 80%.

The heartwater tick (*Amblyomma variegatum*) requires three hosts. The larvae remaining on the host for an average of five to seven days, the nymph for

[4] Walker, J.; Heartwater (Rickettsia Ruminantium); Department of Agriculture, Division of Veterinary Research; Colony and Protectorate of Kenya, Nairobi, East Africa; Bulletin No. 25.

about the same period and the adult female for about ten days to a fortnight. The ticks are easily controlled by dipping.

Contagious Pleuro-Pneumonia

It is said[5] that bovine pleuro-pneumonia has occurred from time immemorial in Central Europe. It remained localized in a portion of Germany, Switzerland, France, and Italy, up till the end of the 17th century, and subsequently extended in various directions. About the middle of the 19th century it had invaded the countries of Western Europe, and as the result of the exportation of infected cattle was introduced into other parts of the world.

From the literature at disposal, bovine pleuro-pneumonia still occurs in parts of Germany, Poland, the Balkans (Roumania), Spain, Russia-in-Asia, India, South America, Australia, Japan, China, and Korea. In Africa, it is known to occur in the Sudan; Senegal; Nigeria; the Central-East African territories, viz. Kenya, Uganda, and Tanganyika; Northern Rhodesia; Bechuanaland; Portuguese East Africa; Barotseland, and probably exists in other remote parts of the African continent.

Bourgelat (1765) was the first to give a good description of bovine pleuro-pneumonia.

Chabert (1794) insisted on its contagiousness, but up till 1846, opinions differed thereon. Delafond (1840) established the different methods of transmission and dissemination of infection, and investigations of commissions appointed in the middle of the nineteenth century substantiated their views. Willems (1852) recorded results of observations which confirmed its contagiousness, and established that the pulmonary or pleural serosity when inoculated subcutaneously to susceptible cattle produced a specific local reaction and conferred an immunity against natural infection, and thus originated a method of immunization which, with some modifications, is employed up to the present day.

Nocard and Roux (1898) with the collaboration of Borrel, Salimbeni and Dujardin-Beaumetz were the first to demonstrate the casual agent of bovine pleuro-pneumonia.

During the following years, Nocard, Roux and Dujardin-Beaumetz (1899) (1901) completed the study of the microbe.

Dujardin-Beaumetz (1900) described its filterability through the Berkefeld and Chamberland F filters; its cultivation *in vitro* in liquid and on solid media, and recorded his success in experimentally producing by subcutaneous inoculation of pure culture a specific local reaction.

South Africa was officially declared free of bovine pleuro-pneumonia in 1914. The measures adopted there consisted of preventive inoculation, slaughter of visibly affected and quarantine of the herd for three months.

In the writer's experience a large number of infected cattle recover and are no longer a source of infection, and this fact would appear partially to explain the successful eradication of the disease in South Africa.

Contagious Abortion in East Africa

In a recent publication on the Prevention and Control of Contagious Abortion, Mettam[6] discusses this world wide disease as it affects the dark continent and particularly Kenya Colony and Protectorate.

Contagious abortion is one of the most prevalent diseases of cattle throughout the entire world and causes more economic loss every year than even tuberculosis.

It exists in all five continents and is far more widespread than was once supposed. The disease has been definitely shown to exist throughout Africa and is

[5] Walker, J.; Pleuro-Pneumonia Contagiosa Bovum; Department of Agriculture; Colony and Protectorate of Kenya, Nairobi, East Africa; address delivered at Pan-African Agricultural and Veterinary Conference at Pretoria, August, 1929; bulletin No. 80.

[6] Mettam, R. W. M.; Prevention and Control of Contagious Abortion; Colony and Protectorate of Kenya, Nairobi, East Africa.

causing great loss every year in the Union, Congo, Rhodesia, and other parts of the continent.

Unfortunately, Kenya has not escaped, for, during the past few years it has been found to be very prevalent in both European and Native-owned herds. It is difficult to state if the disease existed in Eastern Africa before the advent of European cattle, some of whom were probably affected when imported, but it is interesting to remember that contagious abortion has existed in the Nile Valley from earliest times, as we have mention of it in Egypt during the captivity of the Israelites.

It is thus very likely that the aboriginal cattle of Central Africa have been affected for many ages and the promiscuous cattle traffic that existed before the coming of white civilization would only tend to maintain the dissemination of infection. At any rate, it must now be accepted that contagious abortion is one of the most firmly established diseases that the East African farmer has to fight.

There are two methods for control and eradication of this disease: (2), Control by isolation and elimination, and (b), control by vaccination. The latter method is recommended where infection is rife and where cows are bought in the open market, and where there are no ideal facilities for segregation and isolation. It is the method recommended for farming under African conditions.

Hemorrhagic Septicemia—Shipping Fever of Cattle[7]

Hemorrhagic septicemia is an infectious disease, attended with a very high mortality, which attacks various species of animals, especially cattle and sheep. The losses are greatest among young animals, especially those that are thin in flesh and poorly nourished.

A large number of outbreaks of hemorrhagic septicemia, particularly in cattle and sheep, are associated with the shipment of animals from one point to another by rail. This form of the disease is known as shipping fever and usually makes its appearance a few days after animals reach their destination. There is no doubt that the vitality of the animals is lowered as a result of the rigors of transit and as a result some animals become highly susceptible to infection with the hemorrhagic-septicemia germ. Whether the animals, in their condition of lowered vitality, pick up the infection while in transit or whether the organisms, which may be present normally in certain animals, become virulent when the vitality of the individual is lowered, has not been definitely determined.

From what is known of the shipping fever form of hemorrhagic septicemia, it is believed that best results from immunization against this form of the disease should be obtained by the vaccination of the animals with aggressin or bacterins *at least* 10 *days before they are shipped from the home farm.*

[7] Washburn, Henry J.; Hemorrhagic Septicemia—Shipping Fever of Cattle; U. S. Department of Agriculture, Farmers' Bulletin No. 1018.

Avoiding Losses in Shipping of Live Stock

The railroads, through the Western Weighing and Inspection Bureau, have conducted an educational campaign for a number of years with a view of lessening the losses in the shipment of live stock and thus the claims upon the railroads for damages.

Although great improvements have been made in the safe and humane handling of live stock during recent years, heavy losses still occur, and a committee representing the National Live Stock Exchange, the National Traders' Exchange, the railroads, the public stock yards and the National Live Stock Producers Association have formulated a set of rules for the handling of live stock before, during and after shipment.

The work of this committee has been incorporated in a publication by Miller[8] of the Bureau of Animal Industry.

Live stock losses are greatest in the fall and winter. The infectious febrile disease, hemorrhagic septicemia is the most serious of the group of maladies which commonly result from the neglect and exposure of animals in transit. The average annual toll of this disease exceeds $1,000,000, and some years the losses are four times this high.

Some of the directions for avoiding losses in shipment, are:

Avoid hard driving and allow ample time for rest before loading.

Rest and feed the animals before watering.

Avoid overcrowding in cars. In cold weather, bed well. In very severe weather, line the sides of the car with heavy paper.

Plenty of rest at unloading points and regular feeding and watering are essential.

Withholding water from the animals until they are very thirsty so that later they will take a heavy fill, is harmful.

Cattle shipped from the yards back to the country require special attention and care to help them over the period of lowered vitality resultant from the hardships of travel.

Allow access to dry roughage for a few hours before watering.

If feeder cattle are turned on to grass, allow them only a few hours of grazing a day until they become accustomed to the changed feed.

Hemorrhagic septicemia bacterins and aggressins are of value as preventives only. A high degree of immunity is established ten days after treatment, by the use of either bacterins or aggressins. The administration of these agents to animals in transit does not lessen the losses. In fact there is some evidence that losses where aggressins have been administered to animals in transit, are increased.

Anti-hemorrhagic septicemia serum possesses some curative value and its use instead of bacterins or aggressins is recommended where the treatment is administered to cattle in transit or within a few days after they arrive at their destination.

Vaccination Against Tuberculosis

Rankin,[9] in a recent publication, gives a record of work on B. C. G. vaccine carried on in Alberta over a period of approximately four years, during which time some 250 calves were made the subject of experiments. The vaccine was found to be entirely harmless, vaccinated calves developing normally and showing at autopsy no tuberculous lesions. Vaccinated animals in most cases reacted subsequently to the tuberculin test. Calves vaccinated with B. C. G. and immediately exposed to infection showed moderately increased resistance to tuberculosis over unvaccinated controls. Calves vaccinated with B. C. G. and subsequently kept under sanitary conditions for a period, in order to permit resistance to de-

[8] Miller, A. W.; Maintaining the Health of Live Stock in Transit; U. S. Department of Agriculture, Leaflet No. 38.

[9] Rankin, A. C., and Members of Alberta Committee; Vaccination Against Tuberculosis with Bacillus Calmette-Guerin; *Canadian Journal of Research*, Vol. 1, No. 1, May, 1929.

velop before exposure to infection, showed 84 per cent immunity as compared with 21 per cent for the controls. The tuberculous lesions found in vaccinated calves were in general much less pronounced as well as less numerous than those in unvaccinated animals.

This is one of the most encouraging reports so far published in this country concerning the harmlessness and the value of B. C. G. vaccine, and while the experiments were carefully carried out, it should be pointed out that the intervals between the injection of the B. C. G. vaccine and the conclusion that tuberculosis was not produced by it, is much too short in the opinion of many investigators to justify it; and also that the experiments to determine the degree of immunity conferred by the vaccination were not continued over a period sufficiently long, as is indicated for one thing by the fact that the degree of infection in the controls was less than one would expect from a severe exposure.

It is the belief of other careful investigators that B. C. G. vaccination leads to a development of tuberculosis in a considerable percentage of the vaccinated animals after a period of one or two years, and that while a considerable degree of resistance against tuberculosis is conferred by the vaccination, the disease ultimately develops in animals exposed to severe infection.

Topography of the Abdominal Organs in Cattle

Nils Lagerlof,[10] in a recent publication, which it is quite impossible to review in these columns for the reason that an important part of the article is comprised in the 81 full page illustrations, makes available some exceedingly valuable material for cattle practitioners.

The study of the topography of the abdominal organs of cattle was taken up in a systematic manner and followed through with the utmost care, a study being made of the organs in the new born calf and at the ages of one, two, three, four, five, seven and nine months, and of a number of adult animals, some in advanced pregnancy, and some that were not pregnant.

The animals were first given a large dose of chloral hydrate, and when they became unsteady, hooks were passed through the loins, the withers and the neck to suspend them in a natural position. They were then bled to death through the carotid artery and formalin solution injected until the jugular veins were distended, care being taken to prevent the development of gas in the rumen or intestines or the collapse of these organs until they were hardened for three or four days. They were then frozen solidly through and through, and sliced into cross sections varying in thickness from one inch in calves to two inches in the adult animals.

The great care observed to avoid any displacement of the organs through killing or subsequent handling or the development of gas in the rumen or intestines, and the selection of only normal, healthy animals for sectioning, has given more accurate results than those of Ellenberger-Baum or others who have studied the topography of the abdominal organs of cattle.

Bovine Subcutaneous Tuberculosis

The so-called skin lesions of tuberculosis found in cattle and occasionally the only lesions of a suspicious nature observed, have given rise to a considerable research and investigation.

Experimental work carried on during the past year by Mitchell[11] of the Research Station, Hull, has finally resulted in the isolation of two different strains of tubercle bacilli from skin lesions of cattle, through which tuberculosis has

[10] Lagerlof, Nils; Investigations of the Topography of the Abdominal Organs in Cattle, and Some Clinical Observations and Remarks in Conection with the Subject; From the Clinic for Bujatrics and Obstetrics of the Veterinary College, Stockholm, Sweden.

[11] Hilton, George; Report of the Veterinary Director General, Department of Agriculture, Ottawa, Ontario, Canada.

been transferred to laboratory animals, thus clearing away any doubt with regard to the tuberculous nature of skin lesions in cattle. Moreover, further studies of these strains of tubercle bacilli indicate that these differ in some respects from the true bovine type of tubercle bacilli. Further studies are in progress, results of which are likely to reveal a clearer knowledge of the biology of the tubercle bacillus and of the relationship between the different types and the adaptability of the organism to hosts of different animal species.

The Control of Breeding Diseases

At this time when practitioners and dairymen are giving much thought to contagious abortion in cattle, and when the live stock sanitary officials in a number of states have instituted systematic work for the control of this disease, a recent address by Professor Williams[12] is most pertinent.

It will be recalled that when systematic eradication of bovine tuberculosis was undertaken, it was held out to the live stock raiser that in eradicating tuberculosis from the cattle on his premises, he would by the same act free his hogs of this disease. Subsequent events showed that this promise had been made without adequate investigation of tuberculosis in hogs, and that something more must be done to eradicate the disease and even to materially reduce the percentage of infection.

Mishaps such as this tend to shake confidence in procedures and but for the fact that tuberculosis eradication in cattle had shown such splendid economic results and the further fact of its strong public health appeal, the project might have suffered seriously from shaken confidence on the part of the live stock raiser.

Apparently we are just on the threshold of widespread and heroic attempts to control contagious abortion infection in cattle, and to eliminate it from dairy herds. Investigations so far indicate that this is practical and that well directed efforts to this end will be successful.

It is important, however, at the beginning of infectious abortion control work that the breeder be not led to think that the elimination of *Brucella abortus* from his herd is going to solve all of his breeding problems.

If, in the beginning, an educational project on the desirability of eradicating avian tuberculosis and the means of accomplishing it had been made a part of the greater project of bovine tuberculosis eradication, a great deal would have been accomplished by this time in the elimination of tuberculosis from poultry and swine at a marked saving to the live stock industry and at very little additional cost to the Federal and state governments. Unfortunately the importance of this was not foreseen at the time. When the dairyman's interest and enthusiasm for the elimination of contagious abrotion is aroused, is an opportune time to impress upon him the desirability of having a standard for the health of breeding animals, and to take all possible means to reach the standard given by Professor Williams in the address referred to.

The elimination of abortion infection from the herd is desirable, perhaps a primary essential, but it is also desirable to discontinue the practice of breeding heifers when they are too young for reproduction or using bulls to excess. Because of its effect on the calves involved, it is, of course, desirable to avoid pneumonia, white scours, the common diarrheas, and unthriftiness.

Professor Williams' researches indicate that these ailments may have a still more important effect on the breeding value of infected calves than it has on their physical condition. The following excerpts from Professor Williams' address, extensive as they are, omit a considerable

[12] Williams, W. L.; The Burden of Reproduction; Lecture at the ninth annual convention of the Canadian Society of Technical Agriculturists, Winnipeg, Man., June 14, 1928; Printed in Scientific Agriculture, Vol. X, No. 3, November 1929.

amount of his experience cited in support of the statements made and also a number of tables and illustrations. They are sufficient we believe to prove the importance of the subject, and to convey much valuable information to veterinarians having to do with breeding diseases.

So far as I am able to estimate, the heifer retained for breeding produces upon the average less than five calves, in order to do which she copulates more than ten times. It is fairly certain that in a vast majority of cases, when a cow is bred while properly in heat, to a bull of even very low fertility, some one of the billions of spermatozoa meet with, and fertilize the egg, but more than half of such fertilized eggs die and disappear without pregnancy having become recognizable. This is called *sterility*. In those animals which regularly give birth to a single young, like the cow or mare, the common necessity for breeding two or more times before recognizable pregnancy occurs, causes little anxiety upon the part of the owner. When the delay is greatly prolonged the breeder realizes his loss. In comparison with the mare and cow, the sow is not often classed as sterile. More than half the fertilized eggs perish, but the pregnancy continues because of the presence of some living embryos and the disappointment occurs in the size of the litter.

When, in an animal normally giving birth to a single young, the fetus dies and is expelled when of sufficient size that it is observed by the owner it is called *abortion* and causes a panic. If the fetus is born only to die early from disease acquired in the uterus it is designated scours, pneumonia or according to some other symptom and is regarded as a misfortune.

The breeder takes his losses in three or more installments and fails to comprehend the total or the intimate relationship between the various classes of defeat.

It is only within recent years that the problem of reproduction in domestic mammals has taken its place in the front rank, both scientifically and economically. The breeder and the state have been concerned almost wholly with such animal plagues as anthrax and foot-and-mouth disease, but the scene has shifted until today the interferences with reproduction constitute a problem of the first magnitude.

Early in the awakening of the public to the seriousness of the breeding situation I took the position in my writings that the foundation for the control of interferences with reproduction lay in the mating of two sexually healthy individuals. The proposal was largely ignored alike by breeders and veterinarians. Then as now attention was focused upon the observed expulsion by the female, of a dead fetus. Abortion was made the center about which all interferences with reproduction revolved. Abortion was, and still is, attributed to an infection acquired by the female during pregnancy. In so far as such theory is correct, the doctrine that only sexually healthy individuals should be mated is of no fundamental importance. It could no more control sterility, abortion and retained afterbirth, if the infections causing them invade the uterus after conception, than could the mating of sexually healthy individuals control foot-and-mouth disease. Accordingly veterinarians and breeders have sought to control breeding diseases through quarantine upon erroneous basis, by the use of dead and of living abortion baccilli, and by an endless number of abortion-sterility nostrums.

Diseases of the reproductive organs differ markedly from most other maladies familiarly known. An individual of either sex may be seriously or hopelessly diseased sexually without visibly disturbing its general health. The reproductive functions may also, at the will of the breeder, be indefinitely deferred without material peril to the breeding power.

If the proposal be accepted, that successful reproduction must be based upon

the mating of two sexually healthy individuals, it becomes essential to learn the most reliable standards by which sexual health may be measured, how acquired and maintained. The standards for measuring sexual health, as commonly applied by breeders and veterinarians, are extremely inaccurate and misleading. Taking the cow as an example, highly influential writers repeatedly assert that a given cow produced two normal, single calves during one calendar year. If "produced" is to signify the fertilization of the egg, the development of the fetus and the birth of a mature, healthy calf, which it certainly should mean, the production of two calves by a cow in one year is a mathematical impossibility — two pregnancies of 285 days each can not be crowded into one year of 365 days. Numerous eminent writers in this field also state that a given cow "calved correctly" or "normally" although the fetus was dead when expelled or extracted, so that as a matter of fact no birth occurred; and the cow died from retained afterbirth. The literature in this field is saturated with such inaccuracies and renders it highly desirable that some fairly accurate and instructive standard be established for measuring the health of breeding animals.

The following standard is suggested for cattle:

1. Pregnancy shall follow a single service.
2. The duration of pregnancy is 285 days with a variant of five days above or below that figure.
3. The fetus is expelled without human aid within one hour after the commencement of labor.
4. The afterbirth drops away within two hours after the birth of the calf.
5. No recognizable d i s c h a r g e occurs from the genital organs, beyond a small amount of blood and lymph, for two or three hours following the dropping away of the afterbirth.
6. The calf, when expelled, shall be clean and free from stains or other indication of diarrhea before birth. It shall be lively, active and on its feet without aid within an hour. It shall not break down within 48 hours from diarrhea or other disease referable to infection within the uterus.
7. The afterbirth shall be free from important evidence of disease.

The ideals proposed are intimately correlated and each needs to be duly weighed in measuring the degree of sexual health. A cow may make a fair recovery from retained afterbirth and her calf may be apparently well, but when closely studied, upon a series of cases, it will be found that retained afterbirth ordinarily leaves a mark upon both cow and calf. A fetus may suffer from severe illness while in the uterus and, as occurs in diseases of adults, may so far recover that it may be born apparently healthy. A calf may carry in its organs serious infection which it acquired in the uterus, or it may be invaded by the same, or similar, infection soon after birth. The calf may, and often does, so far recover from such disease before it reaches sexual maturity that it may breed satisfactorily, but however complete the apparent recovery, the rule, so far as is known, is that the animal remains permanently more susceptible to disease than one which has been constantly healthy throughout its life from the moment when the egg was fertilized.

Many calves are so badly diseased at birth that they die within 24 to 48 hours. Others live and some of them so far recover as to be able to breed while others remain permanently sterile. Among newborn domestic mammals, dairy calves are the most artificially reared and, as should be logically expected, are, upon the average, the most unhealthy. The mortality of dairy calves from diarrhea, pneumonia and allied diseases is enormous. Many others are critically diseased but apparently recover. Along with these, the vast majority of those not markedly sick, when 5 to 10 days old, lose the ideal lustre of their coats, their feces are sticky

and adhere to the tail, the calf becomes pot-bellied and in general falls below the ideal of health and vigor. When four to six months old they mostly regain the outward signs of health. Then follows, in many dairy herds, an interval of 9 to 12 months before the heifers are bred and compelled to assume the burden of reproduction. If the health of the heifer is ideal, her strength, from the moment when the egg from which she originated was fertilized up to the day she is bred, is wholly available for growth and development of the strength desired for the task of reproduction. If her health has been depressed during the nine months in the uterus and four or five months after birth while sick or in bad health, the period of time during which she may profitably develop strength and the power to resist disease hovering about reproduction, has been curtailed at least one-half, and she experiences the further handicap, that, in order to breed well, she must destroy, or bring under efficient control, those infections or other causes of disease which have been at work. The heifer thus has a task of large proportions.

Conflicting views arise regarding the nature of diarrhea and pneumonia in young calves, some holding that it is of fetal origin, others, that it is due to improper feeding and care after birth. There is little ground for denying either source, nor is the question itself so vitally important as is the fact that such disease is common and causes great loss to the breeder whether the calf dies or reaches breeding age incapable of satisfactorily bearing the burden of reproduction. It is a common observation that, in large dairy herds, where calf diseases are severe, those heifers which survive and apparently recover, prove later to be poor breeders, require numerous services before recognizable pregnancy occurs, largely abort during first pregnancy, those which calve do so largely at less than the ideal 285 days, many have retained after-birth, and in general they violate most of the principles proposed above for measuring healthy reproduction.

In a herd of 500 milk cows, diarrhea and pneumonia were taking one-third of the heifer calves and all were seriously ill or in definitely bad health, and of those which lived to become definitely pregnant, 42.1 per cent aborted. The feeding of calves was changed in 1912, the mortality decreased, the general health was better and, when they reached breeding age, the abortion rate in first pregnancy dropped from 42.1 per cent to 9.8 per cent. That is but part of the story. The heifers of the second group yielded far more milk than the first. There had been no recognizable change in the handling of the two groups except for the calf feeding. They were kept in the same quarters, had essentially the same attendants, and, so far as is practicable in a herd of the size, were bred to the same bulls. The evidence is so massive and the change in production so striking that there is certainly ample ground for concluding that the care of the young calves had a tremendous influence upon their sexual health at breeding age. The ratio of sterility and abortion in the adults had not changed.

The point may be further illustrated by observations in a much smaller herd.

In this herd let us examine the breeding history of 18 purebred heifers over a period of four breeding years. The establishment had, for some years, attempted to grow its calves under pesthouse conditions—in a dark, damp, overcrowded, illy ventilated basement, amidst swarms of flies. The mortality amongst young calves was appalling. The abortion rate in first pregnancy averaged 50%. This group of heifers was hopelessly wrecked in the first breeding year, from which there was no recovery.

The owner pleaded financial inability to provide adequate housing and care for new-born calves. Five healthy heifers

bred to a healthy bull would have produced more and better calves and milk during the 4-year period than did the 18 physical wrecks. The economics of the subject may be variously interpreted but it would appear that it would have cost no more to have grown five healthy, than 18 diseased heifers. Later, the defects in calf growing were largely overcome, the mortality of calves much decreased and the abortion rate in first pregnancy dropped 70%.

Furthermore, the 18 heifers, as soon as recognizably pregnant, each received liberal amounts of killed abortion bacilli. At that date this was the most popular of the many panaceas for "contagious abortion" and is still advocated by highly influential veterinarians. But it lamentably failed to overcome the handicap fastened upon them by disease as young calves—they had not recovered sufficiently to be able to bear the burden of reproduction, although they appeared in splendid health.

A second "sure cure" for abortion is the inoculation of the animal with living abortion bacilli. While this group of heifers was not artificially inoculated with the living bacilli, a study of the table indicates that they acquired plenty of abortion bacilli, or something just as potent, to cause an appalling wreck. It may be objected that, under the prevailing theory, the 18 heifers acquired the infection after they had become pregnant and it would therefore *cause,* not *prevent* abortion in the first pregnancy. But the use of the living bacilli is based upon the allegation that one abortion tends significantly to render the animal immune to abortion thereafter. Of the 11 heifers which aborted in 1912, four (36.3%) did not again abort because they did not again become pregnant—they were permanently immune to abortion. A fifth heifer aborted the next year and then became incurably sterile and hence immune to abortion. The 11 heifers which aborted in 1912 produced during the next four years a total of 17 calves as compared with an ideal of 44—a deficit of 61%. The 17 calves born comprised 6 heifers or an average of 1.5 heifer calves per annum from 11 heifers "immunized" against "contagious abortion" from having aborted. In this group of heifers, abortion as a sure cure for abortion has not proven a spectacular financial success.

A third great abortion remedy which has recently come into popular favor was applied to this group of heifers—they were strictly isolated from all other cattle from the time they were a day or two old until their first pregnancy had come to a close.

The breeder may *repent* his neglect of the health of his young calves, but nature will not *forgive* his sin. He must pay the penalty and pay it abundantly. He can not avoid the deluge by resort to isolation, by the giving of dead, sick or healthy abortion bacilli, by using Smith's abortion remedy, Jones' sure cure for sterility, or by resort to the century-old device of keeping a billy goat in the herd —he must pay the penalty. If he desires to escape these losses his path of safety lies in the direction of taking calves from healthy parents and carefully guarding their health in order to insure ample strength and resistance at breeding age that they may be able to carry the burden of reproduction with safety. The breeder has largely measured the sexual health of his cattle by their physical appearance and has been lamentably misled. Genital disease or defect, which has become established during life in the uterus or soon after birth, soon becomes glossed over by a faultless exterior which belies the state of the reproductive system.

Abortion is the generally accepted index of breeding efficiency, but it is inaccurate and misleading. When abortion is rampant in a herd, the breeding efficiency is admittedly low, but other factors in the long run play the chief rôle. Where I have been able to reach what seemed to me reliable estimates, sterility

has caused at least ten times the loss that could properly be charged to abortion. Incurable sterility is the final breakdown in reproduction, but the great losses occur amongst animals which breed uncertainly after serious delay. Abortion is merely one symptom of sexual disease. Among the other manifestations of sexual disease are sterility, premature birth, difficult birth, retained afterbirth, diseased calves, and monsters.

Duration of Pregnancy an Index of Health*

Veterinarians and breeders have given far too little attention to the meaning of the duration of pregnancy, and have accepted as physiological for the cow anywhere from 240 to over 300 days, while for the mare they have regarded as normal any duration of time between about 310 and 400 days. The failure of the breeder to recognize the fundamental meaning of the duration of pregnancy as a reliable index to the sexual health of his breeding animals has robbed him of one of the most reliable sources of information at his command. The mare and cow abort with somewhat equal frequency. The cow shows a marked tendency toward premature birth; the mare an equally pronounced tendency toward prolonged pregnancy. On the contrary, prolonged pregnancy is rare in the cow; and premature birth perhaps even more rare in the mare. Careful studies of the matter indicate that the causes of premature birth in the cow, and of prolonged pregnancy in the mare, are essentially identical in their nature. The marked contrast in result is perhaps due to wide differences in the fetal membranes, or afterbirths of the two species.

Von Oettingen, studying the meaning of the duration of pregnancy of mares in the famous Prussian stud at Trakehnen, states in his classic work on horsebreeding, that the foals born in that stud at 320 days or less largely developed into outstanding animals while those foaled at 345 or more days were almost never of great value. He presents much highly interesting evidence in support of his views, amongst which he shows that the great stallions of the stud were the products of short pregnancies. In my experience, foals carried grossly overtime are mostly small, sometimes dwarfs, and are frequently seriously or mortally ill at birth.

My studies of the afterbirths of mares show that, aside from rare exceptions of extensive disease, they are heaviest when the duration of pregnancy is not far from 330 to 335 days. Its weight consists, to the extent of 90%, of the blood vessels through which the fetus gets its nutriment. It then follows that in case of a healthy uterus and a correspondingly healthy afterbirth, the vessels, the blood supply, reaches the maximum development, affords the highest available quantity and quality of nourishment, the fetus grows with the greatest rapidity and is born of largest size and greatest vigor. The breeder has long recognized the value of ample feeding of young animals but has overlooked the greater value of proper nutrition during that critical period of its life in the uterus. Of course he admits the value of feeding the pregnant female liberally but he fails to realize that the food may not reach the fetus. The food consumed by the pregnant animal can reach the fetus in proper form and quality only when the uterus is healthy, and in contact with it is a healthy afterbirth. The duration of pregnancy thus becomes a valuable index of the health of the organs through which the fetus is nourished, and hence of the health of the fetus itself. Hence if the duration of pregnancy falls below, or exceeds the ideal, it is evidence that disease or defect is present in the lining membrane of the uterus and in the external layer of the afterbirth of the fetus, the two structures constituting the placenta or organ of exchange of nutriment

* The following paragraphs are excerpted from the same address by Prof. Williams as the preceding article.

and waste products between the mother and her young. The disease or defect indicates that the breeder has imposed upon his animal the burden of reproduction when the genital system was not in a state of health to bear the load with safety.

According to my observations, prematurely born calves are poor prospects. They largely die. Many of those which survive are poor, or non-breeders. There are notable exceptions. Some calves born very prematurely develop into good breeders. The low value has been most conspicuous in those calves born too weak to stand. It has been commonly advised that such weaklings be coddled but it would generally be better if they were killed.

In the ambulatory clinic of the New York Veterinary College for 1927-28, among 45 cases of difficult calving, 31% was in two year old heifers. This marked prevalence of difficult calving in young heifers has commonly been attributed to too large a fetus or too small a genital passage. The calves of young heifers are almost invariably born after a shorter pregnancy than in cows and are smaller in size than from adults. The genital canal is not markedly smaller than in the grown animal. But the tradition of too large calves, or too small genital passages in heifers has served as an opiate to the breeder and he sleepily accepts difficult calving of heifers as natural and inevitable. Modern clinical study indicates that it has a far more important meaning and that difficult calving is generally an indication of sexual disease.

Similarly, in the same clinic, among 114 retained afterbirths, 26.3% occurred in two year old heifers. This can not be explained upon the theory of too large a fetus or too small a genital passage. It thus appears perfectly evident that in two year old heifers there is a marked excess of abortion, difficult calving and retained afterbirth. The breeder apparently places the burden of reproduction, which constitutes a full load for a healthy adult, upon an immature animal, often handicapped by disease established before birth or as a young calf, and she breaks down under the task. In contrast, a progressive Hereford breeder assures me that he regularly gets about 80% of viable calves from his three year old heifers (first calving). His forage appears to be deficient in lime phosphate, and the heifer's reserve is heavily drawn upon during pregnancy and the demand is continued while the calf sucks. He wishes the heifer to calve again at four years old, in order to do which she must again be pregnant 80 days after calving, while the draft upon her store of lime phosphate is continued in order to furnish milk for the calf. For a period the heifer is asked to bear the double load of pregnancy and suckling a calf. She staggers under the load, chews bones, breaks down, and the second calf crop is very unsatisfactory. This breeder also observes that his outstanding show calves, which win blue ribbons at fairs and sell for high prices, are quite largely and conspicuously the progeny of cows which did not calve the previous year and thus enjoyed a long rest during which repairs were possible and nutritive reserves could be established. I have had an interesting discussion with him regarding the possible economy of withholding his three year olds from breeding, give them one year of rest from first calving, re-breed at four years, to calve at five years old, and then as an adult be able to produce a vigorous calf each year over a greater period of time than is possible under the present plan. Since his calf crop from his four year olds is not of great value under present conditions, the experiment should prove interesting and perhaps economically profitable.

The power of reproduction becomes established in the young of a given species at varying ages according to environment. A highly bred and fed heifer may conceive at five or six months of age if opportunity be given and a filly may become pregnant at ten or eleven months.

With some notable exceptions, such early pregnancies are largely aborted or birth is premature and neither young nor parent is of great value. I recall clearly the experience of a client who carelessly permitted a yearling colt to run at pasture with a group of yearling fillies; almost all the fillies became pregnant and all that did so aborted.

I believe the Hereford Association is correct when it bars the early breeding of heifers. Some dairymen claim that causing heifers to calve at two years old advances their dairying efficiency but it is not perfectly clear that in their calculations they have included the aborting heifers, the retained afterbirths and other wrecks in their data, nor do they take into account the longevity of the cow with the total of calves and milk for her life. This feature is well illustrated by the Holstein cow, Glista Ernestine, bred and owned by the New York State College of Agriculture. She lived 5871 days and produced 13 living calves or one calf for each 451.6 days. She yielded for each day of her life 34.4 pounds of milk and 1.6 pounds of butter. Her totals in calves, milk and butter were enormous and were made possible only by having lived more than sixteen years and having retained to the end her physical and sexual health and strength.

Animal husbandmen have too great a tendency to overload their young animals with a view to quick returns. They thereby secure deficient numbers of progeny, of inferior size and quality and far too often wreck, or seriously cripple, their breeding animals. Cattle and horses do not attain their maximum physical and sexual power until seven or eight years of age, by which time most breeding cattle have gone to the shambles, and the breeder has been deprived of the services of his breeding animals at that time during which they should produce the most vigorous and valuable offspring with the greatest regularity.

The data available to me indicate that mares which conceive on the ninth day after foaling are approximately four times as likely to abort as those which become pregnant at a later date, but the tradition is so strong that the ninth day is the most favorable time for breeding mares, that many breeders would prefer to breed a mare at that time and have her abort, than to wait 30 days before breeding and get a healthy foal. In both mares and cows it is the most nearly healthy individuals which are competent to conceive early and yet these do not so well bear the load as the less healthy animals which conceive later.

A study of the sexual load imposed upon bulls is frequently highly interesting. In a large herd, two bulls of essentially the same age were used upon cows of presumably equal fertility over a period of ten years. The more popular one made a total of 691 copulations, the other, 213, or a ratio of 3:1. The former got twice as many heifer calves as the latter, instead of three times as many, as should have been anticipated. Following them into the next generation it was found that each had an equal number of granddaughters. The breeder looks forward to the influence of a great sire upon generation after generation but fails to appreciate fully the fact that sexual health also leaves visible traces over long periods. Some highly influential writers assert that a bull may advantageously serve 100 cows, and authentic records show that some bulls have greatly exceeded that number with success, but these have been exceptional bulls and do not constitute a safe standard for general custom.

One of the most striking illustrations of the consequences of a sexual overload is seen in twin pregnancy in the mare and cow. Twin pregnancy in the mare almost invariably ends in disaster. Living twins are very rare, the physical life of the mare is in peril and her reproductive life is seriously impaired or destroyed. In single pregnancy, if the fetus dies or is seriously ill, the uterus

commonly expels it—the mare aborts. But when twins are present one fetus often dies while the other remains comparatively well for a varying period. Conservative forces step in and the presence of the approximately healthy fetus restrains the uterus and the dead one is not expelled, but an attempt is made to continue the pregnancy on behalf of the living fetus. In the meantime the dead fetus undergoes changes and, in many cases, is largely absorbed by the blood of the mother and the uterus more or less damaged. Finally the disease overcomes the living fetus and the two are expelled, differing widely in the stage of development. This restraint exercised by the presence of a living fetus in the uterus is the saving element in swine, where regularly more than half the fertilized eggs in the uterus perish, are largely absorbed, and those which are not, are retained in the uterus so long as any living fetuses are present, and pregnancy continued to term when living and dead fetuses are expelled together. If the uterus of the sow emptied itself as soon as one fertilized egg dies, swine would become extinct.

Twins in mares frequently appear to be the result of sexual disease. In a badly diseased stud of thoroughbred mares with 26 pregnancies in one year, there were five twin pregnancies which ended as usual. Four of the five mares had been sterile over a discouragingly long period, and proved sterile again the following year. In the recorded data from a herd of cows with three twin pregnancies, each cow died following calving or aborting or became incurably sterile. A cow reported by the Ontario Veterinary College, expelled ten fetuses in twenty months: two sets of twins, two of triplets, aborted in each case at three to four months.

There are some notable exceptions to the above. Some mares and cows apparently twin because of outstanding sexual strength and produce healthy and valuable young.

The effects of the burden of reproduction are shown in a variety of ways, so that by careful observation the breeder may determine the extent of the load which an individual may safely and profitably carry. In addition to those already discussed, two highly important means have recently been placed upon a secure basis for measuring sexual health and strength: the stained spermatozoa of the male and the afterbirth of the female.

In the past, aside from the breeding record itself, the male has been judged by his sexual behavior, the presence or absence of obvious sexual disease, by the motility of freshly discharged spermatozoa and the duration of their motility. While these are of distinct value, it has now been clearly established that by a microscopic study of stained spermatozoa, there is r e v e a l e d through their size, form and other characteristics, accurate information of the utmost value to the breeder, far excelling all other sources of evidence combined. Its chief point of superiority over all other available means is the fact that it makes possible the determination of the degree of fertility after a single copulation, without awaiting the result of the service and in the absence of any physically recognizable disease of the sexual organs. The outstanding value of this means lies in the fact that the state of sexual health and strength may be determined in advance, before the sire shall have had the opportunity to wreck the herd. Technically, if a male causes some of his females to become evidently pregnant, regardless of the number of services required, he is fertile, and as commonly viewed, safe. The fact is that the male which is absolutely sterile is commonly devoid of danger except for a brief delay. It is the male which is capable of impregnating some of his females which is the great peril in the herd. The sire is one-half the breeding unit and his sexual health is of equal importance to that of the entire group of females.

The sexually diseased bull establishes pregnancies which are unsafe, some are aborted, in others birth is premature, retained afterbirth is common and death of the females not rare. In such case the motile spermatozoa are present and pregnancy follows

copulation in many cases. The usual means for determining the efficiency and safety of the male are not operative until, if dangerously diseased, he has wrecked the herd. A proper examination of the stained spermatozoa often prevents the disaster. No other test of equal value is known.

The study of the afterbirth constitutes the most reliable measure known for determining the ability of a female for carrying the burden of reproduction. It is limited to those females which have been pregnant and from which the afterbirth has been obtained. It has been studied most in the cow. It has the special virtue that, with proper study and diligence, the breeder may himself determine the facts in his own herd. When a heifer calf is born there are present and clearly evident four well-developed parallel ridges in the lining membrane of the uterus which extend from end to end of the organ. There are also two rudimentary ridges, not usually so well developed. Upon these ridges the cotyledons or "buttons" of the uterus are developed in four regular rows, with occasional supplementary cotyledons upon the two rudimentary ridges. The total varies, usually between 100 and 110. The cotyledons constitute the physiological contact between the afterbirth of the fetus and the uterus of the cow, by means of which the fetus obtains its nourishment. Once destroyed, they are not reformed, and once damaged, they are not ideally repaired. New structures are sometimes developed in the presence of disease of the regular cotyledons, but the adventitious formations are frail structures of low efficiency in supplying nutriment to the fetus and in guarding it against disease. The numbers and fundamental arrangement of cotyledons remain constant throughout life except that some, many or all of them may be destroyed.

Pregnancy produces important changes in size and in their finer structure, and the growth of the uterus separates them farther from each other. The cotyledons or "buttons" of the afterbirth, which are an essential part of the fetus, are a precise copy of those of the uterus.

The changes caused by disease of the uterus are faithfully recorded in the afterbirth, so that a careful study of the latter reveals the past sexual history of the female and affords a reliable index by which the breeder may measure the ability of the cow to bear the burden of reproduction. In cases studied the agglutination test for Bang's bacillus has been positive alike in the badly wrecked uterus with bad breeding history and in the ideal uterus, with perfect breeding history; cows with badly diseased uteruses with corresponding bad breeding histories have been negative to the test. But after a careful study of more than 400 uteruses and afterbirths at Cornell University, those of us who have participated in the work have found that where the breeding history is available, it checks accurately and reliably with the condition of the afterbirth.

In the case of Glista Ernestine, previously mentioned, the afterbirth from her thirteenth calf clearly showed that she still had a remarkably healthy uterus. She was a great cow and had a great uterus. No cow can be great without a healthy uterus. With a healthy uterus a cow may successfully overcome important barriers. At the zenith of her career, the blood of Glista Ernestine was positive at 1:500 to the agglutination test for "contagious abortion" but with a healthy uterus, that mattered little.

No breeder is justified in purchasing a sexually unsound animal and placing it in his herd. But it is of infinitely greater importance to the intelligent breeder that he study the conditions in his own herd in an effort to advance to the utmost the general, and sexual health of his animals, and to adjust the burden of reproduction to the capacity of his animals to carry it. These things lie well within his jurisdiction and constitute the basis for success. Sexual health is just as essential as pedigree. The animal which has been wrecked sexually can not produce either a satisfactory number or quality of young. Shielding them against "contagious abortion" or other fancied or actual infection from without can not correct the defects within.